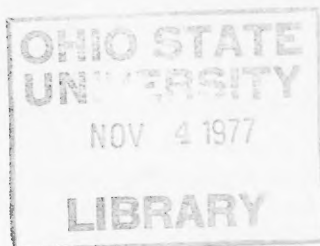


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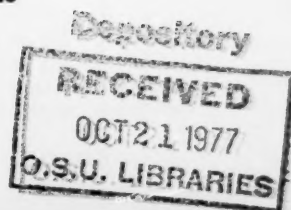
SELECTED ≡ WATER RESOURCES ABSTRACTS

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VOLUME 10, NUMBER 20
OCTOBER 15, 1977

W77-09601 -- W77-10100
CODEN: SWRABW



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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
U.S. Department of the Interior



VOLUME 10, NUMBER 20
OCTOBER 15, 1977

W77-09601 -- W77-10100

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Depart-

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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FOREWORD

Selecting **Water Resources Abstracts**, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

A DSC (DIFFERENTIAL SCANNING CALORIMETRY) STUDY OF HEAT CAPACITY OF VICINAL WATER IN POROUS MATERIALS,
Miami Univ., Fla.

C. V. Braun, Jr., and W. Drost-Hansen.
In: Proceedings of the International Conference on Colloids and Surfaces, 50th Colloid and Surface Science Symposium, San Juan, Puerto Rico, June 21-25, 1976, Colloid and Interface Science, Vol. III, p 533-541. Academic Press, 1976. 2 fig, 20 ref, 1 tab.

Descriptors: *Water properties, *Pore water, Thermal capacity, Porous media, Water structure, Water analysis, Physical properties, Water types, Thermodynamic behavior.
Identifiers: *Vicinal water, *Differential scanning calorimetry.

Vicinal water (adjacent to solid interfaces) is thought to possess structures which differ notably from the bulk structure, and accordingly to show different thermodynamic properties. These properties were measured for various porous media (chromatographic glass, activated carbon, zeolite molecular sieves, and synthetic diamond powder), using a DSC method. Results to date have not provided firm additional evidence for the occurrence of thermal anomalies, but do suggest that the heat capacity of water in porous media is significantly greater than for bulk water, measured by the same technique. Assuming that all of the water present possesses a modified structure, the apparent heat capacity is at least 20% larger than for bulk water and nearly independent of the specific chemical nature of the solid material. (Brown-IPC)
W77-09734

2. WATER CYCLE

2A. General

METHANE OXIDATION IN A EUTROPHIC CANADIAN SHIELD LAKE,
For primary bibliographic entry see Field 5C.
W77-09608

THE ORIGIN AND STRUCTURE OF AMERICAN ARID-ZONE ECOSYSTEMS. THE PRODUCERS: INTERACTIONS BETWEEN ENVIRONMENT, FORM AND FUNCTION,
San Diego Univ., Calif. Dept. of Biology.
P. C. Miller, and H. A. Mooney.

Available from the National Technical Information Service, Springfield, VA 22161 as CONF-740912-3. Price codes: A02 in paper copy, A01 in microfiche. Paper presented at: International Congress of Ecology, The Hague, Netherlands, September 1974. 34 p, 9 fig, 2 tab, 54 ref.

Descriptors: *Arid lands, *Climatic data, *California, *Ecosystems, *Vegetation, Adaptation, Shrubs, Precipitation (Atmospheric), Water utilization, Plant morphology, Soil moisture, Air temperature, Seasonal, Photosynthesis.
Identifiers: *Chile, *Mediterranean climate, *Evergreen shrubs, Plant water potential, Leaf resistance, Deciduous shrubs.

The Mediterranean scrub areas of California and Chile occur in a climate with winter rain, summer drought, and mild winter temperatures, with evergreen sclerophyllous shrubs predominating. Such areas are centered around 32.5 latitude, where climatic and vegetational differences occur between

and within countries; coastal regions are drier than the inland and have more drought deciduous shrubs. California is hotter in the summer and cooler in the winter than Chile, and the vegetation there has a greater frequency of narrow, steeply inclined leaves. Air temperatures and precipitation patterns are discussed. Soil moisture is high throughout the soil profile in winter and spring; drier coastal conditions are also indicated in measurements of plant water potential and leaf resistance to water loss. The occurrence of evergreen, deciduous, shrub and herb forms are described. Narrow, steeply inclined leaves of hot summer active shrubs increase photosynthesis and water use efficiency. (Jahns-Arizona)
W77-09933

WATER SUPPLY FROM SHELBYVILLE AND CARLYLE LAKES AND THEIR OPTIMAL JOINT OPERATION,
Illinois State Water Survey, Urbana. Hydrology Section.
For primary bibliographic entry see Field 4A.
W77-09943

RETURN PERIODS OF HYDROLOGICAL EVENTS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2B.
W77-09958

SENSITIVITY ANALYSIS OF THE WATER QUALITY FOR RIVER-RESERVOIR SYSTEMS MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-09981

APPLICATION OF THE U.S. GEOLOGICAL SURVEY RAINFALL RUNOFF SIMULATION MODEL TO IMPROVE FLOOD-FREQUENCY ESTIMATES ON SMALL TENNESSEE STREAMS,
Geological Survey, Nashville, Tenn. Water Resources Div.
H. C. Wibben.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 566. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 76-120, 1976. 53 p, 12 fig, 4 tab, 11 ref.

Descriptors: *Flood forecasting, *Flood frequency, *Model studies, *Tennessee, *Small watersheds, Analytical techniques, Simulation analysis, Rainfall-runoff relationship, Peak discharge, Correlation analysis, Hydrologic data, Evaluation.
Identifiers: *Rainfall-runoff models.

The U.S. Geological Survey rainfall-runoff simulation model was used in conjunction with National Weather Service climatological data to improve flood-frequency estimates for 52 small drainage basins in Tennessee. The basins range in size from 0.17 to 64 square miles (0.44 to 166 square kilometers) and are distributed throughout the State. Model parameters were determined by calibration with observed data from each site. Average error of peak discharge simulation was about 36 percent. Techniques used in screening data for calibration as well as those used to optimize parameter values are discussed. A scheme developed to assess the relative accuracy of the frequency curves based on observed and simulated data indicated that the simulated data are equivalent to nine years of observed data in defining 2-year floods, and fifteen years in defining 100-year floods. Discharges corresponding to the best estimate of flows for selected recurrence intervals are tabulated for each modeled basin. (Woodard-USGS)
W77-10004

SMALL CATCHMENT FLOOD MODELLING,
South African Dept. of Water Affairs, Pretoria. Div. of Hydrology.
For primary bibliographic entry see Field 2E.
W77-10083

2B. Precipitation

SATELLITE-DERIVED GLOBAL OCEANIC RAINFALL ATLAS (1973 AND 1974),
National Aeronautics and Space Administration, Greenbelt, Goddard Space Flight Center.
For primary bibliographic entry see Field 7C.
W77-09693

WEATHER MODIFICATION EFFECTS AND MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS),
National Technical Information Service, Springfield, Va.
R. J. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as NTIS/PS-76/0931. Price codes: N01 in paper copy, N01 in microfiche. Report NTIS/PS-76/0931, November 1976. 269 p.

Descriptors: *Weather modification, *Bibliographies, *Management, *Abstracts, Cloud seeding, Meteorology, Legal aspects, Weather, Climates, Effects, Water supply, Arid climates, Ecology, Precipitation (Atmospheric), Artificial precipitation, Remote sensing.
Identifiers: Weather modification effects.

The bibliography cited adverse and beneficial effects, effect on the climate, legal aspects, ecological effects, and the effect upon water supplies of weather modification. Studies related to the management and utilization of weather modification to increase the water supply in arid regions were included. Topics dealing with the theory and physics of cloud seeding and precipitation nucleation were excluded. This updated bibliography contains 172 abstracts, 47 of which are new entries to the previous edition. (Froehlich-ISWS)
W77-09694

TEMPORALLY AND AREALLY DISTRIBUTED RAINFALL,
Agricultural Research Service, Athens, Ga. Southeast Watershed Lab.
J. D. Dean, and W. M. Snyder.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 103, No. IR2, Proceedings Paper 13002, p 221-229, June 1977. 7 fig, 2 tab, 10 ref, 1 append.

Descriptors: *Climatology, Computers, *Floods, *Irrigation, *Rainfall intensity, Rainfall-runoff relationships, Rain gages, Optimization, Storms, Raindrops, Temporal distribution, Planning, *Rainfall disposition.
Identifiers: *Rainfall distribution, *Temporally distributed rainfall, Grid, Areally distributed rainfall, Grid element, Climatic determinations, Arithmetic mean, Thiessen method.

Areally distributed rainfall was computed readily by superimposing a square grid on the area of interest. Weights for each grid element for each rain gauge affecting the area were made functions of reciprocal distance to some power. Optimization confirmed the value of the exponent that is in general use. The method can be used to calculate the areal average of storm, day, or longer, total precipitation in climate determinations or water resource planning. Also, the method can be used to calculate moving fields of rainfall by short-time increments during the progress of a storm over an area. (Roberts-ISWS)
W77-09696

Field 2—WATER CYCLE

Group 2B—Precipitation

EXPERIENCES WITH THE USE OF THE AEROLOGICAL METHOD IN EVAPORATION STUDIES IN NORTHWESTERN EUROPE. Helsinki Univ. (Finland). Dept. of Meteorology. For primary bibliographic entry see Field 2D. W77-09710

RELATION OF SOME METEOROLOGICAL ELEMENTS TO AVALANCHING IN THE DUKANT RIVER BASIN (WESTERN TIEN-SHAN). For primary bibliographic entry see Field 2C. W77-09718

ACCELERATION TO TERMINAL VELOCITY OF CLOUD AND RAINDROPS. California Univ., Los Angeles. Dept. of Atmospheric Sciences. P. K. Wang, and H. R. Pruppacher. Journal of Applied Meteorology, Vol. 16, No. 3, p 275-280, March 1977. 4 fig, 20 ref. NSF DES75-09999.

Descriptors: *Raindrops, *Clouds, *Velocity, Particle size, Laboratory tests, Equations, Settling velocity, Pressure, Temperature, Drag, Cloud physics, Meteorology. Identifiers: *Terminal velocity(Clouds and raindrops).

A theoretical method was given which allows computing the acceleration to terminal velocity of cloud and raindrops at various levels in the atmosphere. For drops of an equivalent radius between 800 and 3500 micrometers, theoretical predictions were found to agree well with the results of an experimental study carried out in the UCLA Rain-Shaft. For drops of a radius between 20 and 80 micrometers, theoretical predictions were found to agree well with the experimental results of Sartor and Abbott. Experiment and theory indicated that in air of 1000 mb and 20 C, drops of a radius greater than 1000 micrometers need distances of at least 12 m to accelerate to terminal velocity. (Sims-ISWS) W77-09719

DEDUCTION OF ICE PARTICLE TYPES IN THE VICINITY OF THE MELTING LAYER FROM DOPPLER RADAR MEASUREMENTS. Washington Univ., Seattle. Dept. of Atmospheric Sciences. R. R. Weiss, Sr., J. D. Locatelli, and P. V. Hobbs. Journal of Applied Meteorology, Vol. 16, No. 3, p 314-316, March 1977. 5 fig, 5 ref. NSF ATM-74-14726-A02.

Descriptors: *Precipitation(Atmospheric), *Cloud physics, *Radar, Snow, Graupel, Rime, Aggregates, Ice, Crystals, Rainfall, Raindrops, Settling velocity, Temperature, Melting, Meteorology. Identifiers: *Ice particles, Ice particle types, Dendrites, Doppler radar.

A technique was described for deducing, from vertically pointing Doppler radar measurements, whether the predominant ice particles just above the melting layer are graupel or aggregates of ice crystals. Under certain conditions, the type of graupel and the type of ice crystals which comprise the aggregates can be deduced. (Sims-ISWS) W77-09720

THE ORIGIN AND STRUCTURE OF AMERICAN ARID-ZONE ECOSYSTEMS. THE PRODUCERS: INTERACTIONS BETWEEN ENVIRONMENT, FORM AND FUNCTION. San Diego Univ., Calif. Dept. of Biology. For primary bibliographic entry see Field 2A. W77-09933

ARID LANDS OF SUB-SAHARAN AFRICA. National Academy of Sciences, Washington, D.C. Commission on International Relations.

For primary bibliographic entry see Field 6E. W77-09934

ICE NUCLEATION BY MICAS. Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research. J. H. Shen, K. Klier, and A. C. Zettlemoyer. Journal of Atmospheric Sciences, Vol. 34, No. 6, p 957-960, June 1977. 2 fig, 1 tab, 24 ref.

Descriptors: *Nucleation, *Cloud physics, *Cloud seeding, Laboratory tests, Crystals, Crystallization, Clouds, Precipitation(Atmospheric), Rain, Chemistry of precipitation, Freezing, Meteorology. Identifiers: *Micas, Fluorine micas, Fluorophlogopite, Nucleants.

A fluorine mica, fluorophlogopite, was found to produce higher bulk water freezing temperature than many other nucleating agents including the parent hydrophlogopite and even silver iodide. It is the most efficient catalyst yet found in this Laboratory. Fluorophlogopite has an inherently large mismatch with ice crystals, but the water cluster embryo apparently is sustained by an F-H-O hydrogen bond assisted by neighboring potassium ions. (Sims-ISWS) W77-09956

RETURN PERIODS OF HYDROLOGICAL EVENTS. Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering. D. Rosbjerg. Nordic Hydrology, Vol. 8, No. 1, 57-61, 1977. 1 ref.

Descriptors: *Annual peak discharge, *Poisson ratio, *Hydrology, Precipitation(Atmospheric), Stochastic processes, Model studies, Rainfall disposition, Floods, Rainfall intensity. Identifiers: *Return periods, *Hydrological events, Annual maxima series, Annual exceedance series, Rainfall records.

A relation between return periods of hydrological events in annual maxima and partial duration series respectively was shown to be exactly fulfilled when the events take place according to a Poisson process. Furthermore, it was shown that the relation can be used as a good approximation when dealing with more regular processes than the Poissonian. A record of rainfall depths was analyzed. (Roberts-ISWS) W77-09958

RAINFALL TRENDS IN 80 RAINFALL DISTRICTS OF SOUTH AFRICA. South Africa Univ., Pretoria. Dept. of Geography. P. A. Onesta, and P. Verhoef. South African Journal of Science, Vol. 72, No. 9, p 274-276, September 1976. 2 fig, 2 tab, 12 ref.

Descriptors: *Rainfall, Regression analysis, Statistical analysis, *Precipitation(Atmospheric), Rainfall disposition, Africa. Identifiers: *South Africa.

Reports are presented on the testing of the rainfall data in South African rainfall districts for long-term trends, and some parameters are established for future research work. Linear functions fitted for the period 1921-1970 showed a decrease in rainfall receipts over the eastern part of the country. (So African Water Info Center) W77-10085

ON THE APPLICATION OF TREND SURFACES OF PRECIPITATION TO MOUNTAINOUS AREAS. Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering. R. E. Schulze.

Water SA, Vol. 2, No. 3, p 110-118, July 1976. 5 fig, 5 tab, 14 ref.

Descriptors: *Rainfall, Topography, Statistical methods, Thunderstorms, Rain gages, *Precipitation(Atmospheric), Africa, Watersheds(Basins). Identifiers: Drakensberg, Cathedral Peak, South Africa.

The distribution of precipitation in mountainous, high runoff producing areas is a complicated function of atmospheric and surface interactions; for superimposed on a regional pattern of precipitation are influences of local topography and rain-gauge exposure. In hydrological modelling, studies indicate that the reliable and representative estimation of areal precipitation is very important for the successful simulation of streamflow events. The application of trend surface analysis to the estimation of catchment precipitation is tested at Cathedral Peak in the Natal Drakensberg. Results using this technique are shown to be successful for long-term, but not for short-term, more localised, precipitation records. (So African Water Info Center) W77-10088

THE TEMPORAL VARIATION OF RAINFALL RUNOFF OVER THE SUMMER RAINFALL REGION OF SOUTH AFRICA. University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography and Environmental Science. M. A. Abbot, and T. G. Dyer. South African Journal of Science, Vol. 72, No. 9, p 276-278, September 1976. map, 5 fig, 13 ref.

Descriptors: *Rainfall, Storm runoff, Summer, Temporal distribution, Time series analysis, Forecasting, Floods, Climatology, Droughts, Gaging. Identifiers: South Africa.

Earlier work has shown that the rainfall over South Africa displays a pseudo-regular pattern with time and is of a regional character. Precipitation over the summer rainfall region oscillates with a period of the order of 20 years, which decreases in amplitude towards the southern part of the sub-continent. In the all-season coastal belt, rainfall displays two weaker oscillations, with periods of 10 and 20 years, respectively. In the present study, records of 10 runoff gauges were investigated. Runoff and rainfall exhibit the same oscillatory character which has a wavelength of approximately 20 years. For the summer rainfall region information now exists which will assist in the forecasting of droughts and floods, subject to the condition that the general circulation of the atmosphere over the sub-continent continues to behave as it has done for the past sixty years. (So African Water Info Center) W77-10091

2C. Snow, Ice, and Frost

PRECIPITATION TREND AND STORM ANALYSIS IN COLORADO. Colorado State Univ., Fort Collins. Dept. of Atmospheric Science. M. S. Kuo.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 250. Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, Summer 1975. 64 p, 13 fig, 20 tab, 26 ref. OWRT A-018-COLO(1).

Descriptors: *Colorado, *Precipitation(Atmospheric), Data collections, *Statistical methods, *Storms, Rainfall intensity, Rainfall disposition, *Thunderstorms.

The precipitation trend in Colorado was studied statistically using 56 years of data collected at 61

stations. The precipitation is found to have an annual decrease of 0.01 inches over the 56 year period although this result was not statistically significant. Precipitation periods (referred to as storms) were used to describe the variation of the precipitation in space and time. The state of Colorado was divided into six geographic regions, and area weighted hourly precipitation data were summed to obtain the volume of water yielded by each storm. It was found that 80% of the annual volume is produced by 30% of the storms. The western third of the state shows no marked seasonal variation in precipitation, but the southern half receives more precipitation than the northern half. The middle third of the state receives 60% of its precipitation in the summer, and the eastern part, the high plains, receives 80% during the summer months. Thunderstorms predominate during the summer, large scale storms in the winter. The summer precipitation volume is correlated with the annual volume in all regions. After categorizing the storms events of all sizes than the driest years with no noticeable change in the distribution of the size of the storms. (Martin-Colo-St).
W77-09685

BASAL TILL FABRICS OF MODERN ALPINE GLACIERS,
Washington Univ., Seattle. Dept. of Geological Sciences.
H. H. Mills.
Geological Society of America Bulletin, Vol 88, No 6, p 824-828, June 1977. 4 fig, 3 tab, 29 ref.

Descriptors: *Glaciers, *Till, *Glacial soils, Glacial drift, *Glacial sediments, Soils, Soil types, Ice, Geological surveys, Data processing, Geology, Glaciology.
Identifiers: Till fabrics, Modern glaciers, *Basal tills.

Basal-till fabrics from three alpine glaciers ranging in length from 2.5 to 7.5 km were analyzed. Fabric patterns are similar to those reported from basal tills of lowland glaciers: a single model parallel to iceflow direction and a preference for upglacier dips. Eigenvalue analysis, however, showed that the preferred planes of the axes are weaker than those reported from one Pleistocene ice sheet. Two methods of analysis indicated that there is little relation between clast orientation and clast size or shape. (Sims-ISWS)
W77-09704

NORTH ATLANTIC ICE-RAFTING: A MAJOR CHANGE AT 75,000 YEARS BEFORE THE PRESENT,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 2J.
W77-09706

MOVEMENT OF SNOW AVALANCHES,
N. S. Bakhvalov, A. G. Kulikovskiy, V. N. Kurkin, Ye. I. Svesnikova, and M. E. Eglit.
Soviet Hydrology, Selected Papers, No 4, p 243-248, 1975. 4 ref, 3 fig. Translated from Transactions of the Central Asian Regional Hydrometeorological Scientific Research Institute (Trudy SARNIGMI), No 15(96), p 3-15, 1974.

Descriptors: *Avalanches, *Snow, *Model studies, Theoretical analysis, Movement, Snowpacks, Foreign research, Movement, Mathematical models, Analytical techniques, Analysis, Mathematical studies, Hydraulics, Flow, Velocity, Profiles.
Identifiers: *USSR, *Snow dust avalanches.

Theoretical analyses were presented for the movement of dense dry or wet snow avalanches and a snow dust avalanche along a slope. For the dry or wet avalanches, the snow movement was described by equations similar to those used in

hydraulics to describe homogeneous liquid flows. It was assumed that it is sufficient to take into account only the average parameters over the cross section thickness of the moving layer. And for the forces of resistance associated with internal friction for a uniform velocity distribution in the avalanche, one can use the laws of hydraulics. For the movement of snow dust forming a snow avalanche or air wave accompanying some dense avalanches, the complete equations of the hydraulics of turbulent flows of mixtures of various components were used. (Humphreys-ISWS)
W77-09716

MATHEMATICAL DESCRIPTION OF SOME PHYSICAL SNOW COVER CHARACTERISTICS,
Yu. M. Denisov, and Ye. B. Trofimova.
Soviet Hydrology: Selected Papers, Issue No 4, p 249-251, 1975. 2 fig. Translated from Transactions of the Central Asian Regional Hydrometeorological Scientific Research Institute (Trudy SARNIGMI), No 15(96), p 87-93, 1974.

Descriptors: *Snow cover, *Mathematical models, *Moisture content, Ice, Water, Temperature, Air temperature, Evaporation, Foreign research, Foreign countries, Snow, Mathematical studies, Analytical techniques.
Identifiers: *USSR, Heat transport, Moisture transport.

Snow cover was regarded as a complex system consisting of three phases: ice, water, and moist air. On this basis, a system of equations was derived, describing heat and moisture transport in the snow, which gave the particular solution of a one-dimensional problem for dry snow. In constructing a mathematical model, it was assumed that ice particles in the snow always are coated with water, and, if the pores in the snow are not completely filled with water, air can border only on water. Computation results were presented for snow temperatures at various depths and for the variations of evaporation from the snow surface. Snow surface temperature variations repeated the pattern of air temperature fluctuations, and the fluctuations attenuated with depth were shifted in time. (Humphreys-ISWS)
W77-09717

RELATION OF SOME METEOROLOGICAL ELEMENTS TO AVALANCHING IN THE DUKANT RIVER BASIN (WESTERN TIEN-SHAN),
M. K. Yefimov, and Ye. M. Kozik.
Soviet Hydrology, Selected Papers, No 4, p 252-255, 1975. 2 tab. Translated from Transactions of the Central Asian Regional Hydrometeorological Scientific Research Institute (Trudy SARNIGMI), No 15(96), p 144-148, 1974.

Descriptors: *Avalanches, *Snow, *Forecasting, On-site investigations, Analysis, Evaluation, Climatology, Equations, Snow cover, Foreign research, Foreign countries, Air temperature.
Identifiers: *USSR(Dukant River Basin).

Avalanching is known to depend strongly on meteorological conditions and on snow cover properties, which are determined mainly by the preceding weather. The effect of some given meteorological elements on avalanching varies, depending on physiographic conditions, but has not been sufficiently studied to forecast avalanching reliably or to indicate avalanche danger or the lack of it. Avalanching was studied in the area of the Dukant avalanche station. Factors considered were: (1) average daily, maximum, and minimum air temperatures at a height of 2.0 m above the soil surface; (2) amount and type of precipitation; and (3) snow cover depth and its variation in the course of the day. Linear regression equations of the relationships obtained for 128 avalanches were tabulated. The formulas were recommended for forecasting avalanches after the date of establishment of a permanent snow cover

and subsequent snowfall totaling 60 mm, which is necessary to cover small shrubs, rocks, and other surface irregularities that prevent avalanche formation on mountain slopes. (Humphreys-ISWS)
W77-09718

DEDUCTION OF ICE PARTICLE TYPES IN THE VICINITY OF THE MELTING LAYER FROM DOPPLER RADAR MEASUREMENTS,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 2B.
W77-09720

ICE NUCLEATION BY MICAS,
Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
For primary bibliographic entry see Field 2B.
W77-09956

2D. Evaporation and Transpiration

WATER EXCHANGE OF JUICY FRUITS OF TREES AND BUSHES, (IN RUSSIAN),
N. I. Antipov.
Fiziol Rast (Mosc) 23(1), p 152-155, 1976.

Descriptors: *Trees, Age, *Fruit crops, *Transpiration, *Moisture content, *Shrubs.
Identifiers: Aronia melanocarpa, Berberis vulgaris, Cerasus vulgaris, Crataegus sanguinea, Frangula alnus, Phellodendron reclinata, Lonicera xylosteum, Padus racemosa, Phellodendron amurense, Prunus spinosa, Rhamnus cathartica, Ribes nigrum, Ribes rubrum, Rosa majalis, Sambucus racemosa, Sorbus aucuparia, Transpiration, Trees, Viburnum-opulus.

Transpiration and water content were studied in the juicy fruits and leaves of 17 spp. of trees and bushes (Cerasus vulgaris, Padus racemosa, Ribes rubrum, R. nigrum, Grossularia reclinata, Prunus spinosa, Crataegus sanguinea, Sorbus aucuparia, Aronia melanocarpa, Phellodendron amurense, Sambucus racemosa, Lonicera xylosteum, Rhamnus cathartica, Rosa majalis, Viburnum opulus, Frangula alnus, Berberis vulgaris). The rate of transpiration calculated per wet mass was much lower in the fruits than in the leaves. The rate of transpiration calculated per surface unit was higher in the young fruits and lower in the ripe fruits in comparison with leaves. The water content was higher in the young fruits, which use it at a higher rate than the ripe fruits in the process of transpiration.—Copyright 1976, Biological Abstracts, Inc.
W77-09611

EXPERIENCES WITH THE USE OF THE AEROLOGICAL METHOD IN EVAPORATION STUDIES IN NORTHWESTERN EUROPE,
Helsinki Univ. (Finland). Dept. of Meteorology.
M. Alestalo, and H. Savijarvi.
Nordic Hydrology, Vol 8, No 1, p 47-56, 1977. 4 fig, 3 tab, 9 ref.

Descriptors: *Evaporation, Europe, *Synoptic analysis, Water vapo, Humidity, Precipitation (Atmospheric), Meteorological data, Cyclones, Surface waters.
Identifiers: *Aerological methods, *Baltic Sea.

Two different approaches of the aerological method were used for estimating evaporation in northwestern Europe in the period 1969-1970. Daily operational aerological observations gave better results for homogeneous areas than for a nonhomogeneous surface. One drawback in the mentioned approach was the non-uniform station network due to a lack of observations and resulting in scattered values even for monthly means. Based on annual mean moisture fluxes at the aerological stations, the evaporation from the

Field 2—WATER CYCLE

Group 2D—Evaporation and Transpiration

Bothnian Sea was estimated to be about 33 mm/year. The main convergence of the water vapor flux occurred below the 900 mb level and was largely due to the mean part of the flux. The results appeared to be dependent on the homogeneity of the data sample. In both approaches, the main sources of error was the lack of data and the low quality of available data, because divergence calculations are sensitive to errors in wind data. The linearity approximation used also failed in low levels. Careful data checking and the use of complete data samples are needed when the aerological methods is applied. (Roberts-ISWS)
W77-09710

A MODEL OF TRANSPARATION AND INTERCEPTION LOSS FROM A SPRUCE FOREST IN PLYNIMON, CENTRAL WALES.
Institute of Hydrology, Oxon (England).
I. R. Calder.
Journal of Hydrology, Vol 33, No 3/4, p 247-265, May 1977. 5 fig, 2 tab, 11 ref.

Descriptors: *Transpiration, *Interception, *Forests, *Forest watersheds, *Evaporation, *Lysimeters, *Weather data, *Optimization, *Model studies, *Foreign studies, *Foreign research, *Stations.
Identifiers: *Interception loss, *Wales (Plynlimon), Spruce forest.

A model of evaporation loss (interception plus transpiration) from a spruce forest, based on the Penman-Monteith equation, was derived from lysimeter and automatic weather station data. Values for the aerodynamic resistance and the other canopy parameters required by a Rutter type of interception model were obtained using optimization techniques. The techniques also were used to obtain the parameter values in a transpiration model which made use of the empirical surface resistance equation. Good agreement with observation was found for transpiration predictions at all times. Good predictions of interception loss were obtained only if small zero offset errors in the measurement of vapor pressure deficit were absent. The feasibility of using the model, together with the derived parameter values, to predict losses from spruce forests in other locations, was discussed. A wide range of meteorological data were available for the study, covering the typical year of 1974 and the exceptionally hot and dry summer of 1975. The data were deficient in one important respect: significant amounts of snowfall did not occur in either year, and it was not possible to test the models of snow evaporation from the canopy. (Roberts-ISWS)
W77-09711

EVALUATION OF AN EVAPOTRANSPIRATION MODEL FOR CORN.
Kansas State Univ., Manhattan. Dept. of Agronomy.
W. D. Rosenthal, E. T. Kanemasu, R. J. Raney, and L. R. Stone.
Agronomy Journal, Vol 69, No 3, p 461-464, May-June 1977. 4 fig, 1 tab, 16 ref.

Descriptors: *Evapotranspiration, *Model studies, *Corn (Field), *Kansas, *Soil water, *On-site tests, *Computer models, *Input-output analysis, *Irrigation practices, *Meteorological data, *Withdrawal, *Soil profiles, *Crop response.
Identifiers: *Neutron attenuation, *Water use efficiency.

An empirical evapotranspiration model was developed and tested for corn (Zea mays (L.) cv. Dekalb XL72A) grown on two sites in Kansas; soil water estimates determined by the computerized model were compared with neutron attenuation estimates. Required daily inputs for the model include leaf area index, solar radiation, effective precipitation and maximum and minimum air temperatures; outputs include transpiration, evapora-

tion, advective contribution and soil water content. Model estimates were within 6% of neutron attenuation estimates during the growing season. The greatest water use efficiency and yield was achieved with an irrigation treatment involving 40% depletion of the maximum available water in the 150-cm profile. The model used has potential in scheduling irrigation on corn since required meteorological inputs can be routinely obtained at the field site. Leaf area index must be measured, estimated from remote sensing techniques, or simulated from leaf growth models. (Jahns-Arizona)
W77-09941

EFFECT OF INCREASING FOLIAGE REFLECTANCE ON THE CO₂ UPTAKE AND TRANSPARATION RESISTANCE OF A GRAIN SORGHUM CROP.
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Agricultural Meteorology.
S. Moreshet, G. Stanhill, and M. Fuchs.
Agronomy Journal, Vol 69, p 246-50, March-April 1977. 6 fig, 3 tab, 7 ref.

Descriptors: *Reflectance, *Leaves, *Photosynthesis, *Transpiration control, *Grain sorghum, *Solar radiation, *Dry farming, *Crop response, *Crop production, *Spectrophotometry, *On-site tests.
Identifiers: *Foliage reflectance, *CO₂ uptake, *Kaolin spraying, *Leaf resistance, *Israel, *Senescence.

Two years of field studies of labeled CO₂ uptake rates on kaolin-sprayed and unsprayed sorghum leaves indicated the coating caused a 23% decrease in net photosynthesis similar to the 26% reduction of solar radiation absorption detected with a spectrophotometer after spraying. Measurements were made during the rainless summers of 1973 and 1974 on an unirrigated sorghum crop (Sorghum bicolor L. Moench 'Hazera 726') in the Lakhish area of Israel. Grain yield increases had occurred after whitening of the crop canopy. Decreased photosynthesis persisted for several weeks and was greater 6 weeks after the last kaolin application. Most leaves had a slightly increased leaf resistance as well as reduced CO₂ uptake; both effects were accentuated by high insulation. Enhanced senescence of the kaolin-coated leaves was confirmed by measurements of the dynamics of light-dependent CO₂ uptake of leaves of different ages using neutral filters and independent measurements of green leaf area. However, field measurements with a diffusion porometer indicated only slight reductions in the leaf surface diffusion resistance of coated leaves. A possible explanation is presented to reconcile the decrease in photosynthesis with the observed grain yield increase of treated sorghum. (Jahns-Arizona)
W77-09942

ON PENMAN'S EQUATION FOR ESTIMATING REGIONAL EVAPORATION.
Edinburgh Univ. (Scotland). Dept. of Meteorology.
A. S. Thom, and H. R. Oliver.
Quarterly Journal of the Royal Meteorological Society, Vol. 103, No. 436, p 345-357, April 1977. 4 fig, 28 ref.

Descriptors: *Evaporation, *Equations, *Regional analysis, *Estimating, *Ventilation, *Rainfall, *Radiation, *Meteorology, *Forecasting, *Winter, *Summer, *Vegetation.
Identifiers: *Penman's equation, *Regional evaporation, *Hydrometeorology, *Radiant energy, *Energy balance, *Aerodynamic terms.

The form of Penman's evaporation equation most extensively applied in hydrometeorology was discussed. It was shown that the equation underemphasizes the importance of ventilation relative to radiation in maintaining regional evaporation. A generalized ventilation term was proposed,

and a modified equation for evaporation was derived. The new equation was calibrated to give the same annual total for short vegetation as Penman's original version. The new equation predicted both an enhancement of winter evaporation at the expense of summer evaporation and a significant increase in annual total evaporation with vegetation size, especially in regions of frequent substantial rainfall. (Roberts-ISWS)
W77-09953

EVAPORATION FROM A WARM, WAVY SURFACE: A LABORATORY STUDY.
Delaware Univ., Newark. Coll. of Marine Studies.
R. J. Lai.
Journal of Physical Oceanography, Vol. 7, No. 3, p 431-435, May 1977. 6 fig, 15 ref.

Descriptors: *Evaporation, *Surfaces, *Laboratory tests, *Stratified flow, *Water, *Laboratory equipment, *Winds, *Laboratories, *Convection, *Waves (Water), *Sprays.
Identifiers: *Evaporation rates, *Wind waves, *Wave conditions, *Forced convection, *Free stream velocity, *Stratified air flow, *Buoyancy flux.

The evaporation rates from small wind-waves by forced convection in a range where the spray of water by strong wind action was not important were studied in a laboratory. The effects on evaporation of free stream velocity, wave conditions, and temperature differences between air and water (either stable or unstable stratified air flow) were investigated. For stably stratified air flow, the evaporation rate correlates well with general dynamical parameters but not for unstably stratified flow. The buoyancy flux near the boundary appears to play an important role in moisture transfer at the sea-air interface. The effect of the buoyancy flux was considered important inside the diffusion sublayer. The thickness of the diffusion sublayer is not only a function of shear velocity and roughness, but it is also a function of buoyancy flux. Therefore, a final form of evaporation rate can be given in a dimensionless form that applies well to both stable and unstable stratified flow and indicates that the buoyancy flux from the boundary strongly affects the evaporation rate. (Roberts-ISWS)
W77-09954

2E. Streamflow and Runoff

BRINK DEPTH METHOD IN RECTANGULAR CHANNEL.
Agricultural Univ., Wageningen (Netherlands).
Dept. of Hydrology and Catchment Hydrology.
For primary bibliographic entry see Field 8B.
W77-09695

DEEP DISTRIBUTARY CHANNELS AND GIANT BEDFORMS IN THE UPPER CARBONIFEROUS OF THE CENTRAL PENNINES, NORTHERN ENGLAND.
Keele Univ. (England). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W77-09700

OPTIMAL OPERATION OF FLOOD CONTROL SYSTEMS, (FINAL REPORT; V.II).
Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 4A.
W77-09927

THE ORIGIN OF HORIZONTAL LAMINAE IN EPHEMERAL STREAM CHANNEL-FILL.
Birbeck Coll., London (England). Dept. of Geology; and Birbeck Coll., London (England). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W77-09950

STATISTICAL ANALYSIS OF THE IMPACT OF GROUND WATER PUMPAGE ON LOW-FLOW HYDROLOGY, Wisconsin Univ., Oshkosh. Dept. of Geology. For primary bibliographic entry see Field 4B. W77-09952

COMPUTATION OF UNSTEADY FLOWS IN RIVERS AND ESTUARIES BY THE METHOD OF CHARACTERISTICS, Geological Survey, Reston, VA. Water Resources Div. C. Lai, and C. A. Onion. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253-785. Price codes: A10 in paper copy, A01 in microfiche. Computer Contribution Report, June 1976. 186 p, 5 fig, 3 tab, 5 ref.

Descriptors: *Model studies, *Unsteady flow, *Rivers, *Estuaries, *Computer models, Open channel flow, Analytical techniques, Computer programs, Mathematical models.

This report is a program documentation to the latest revision (1975) of the unsteady open-channel flow simulation model by the method of characteristics, Version 13 in the program series, which employs a multiple-reach scheme treating each subreach as a prismatic shape. A long waterway of variable cross section, properties and coefficients may be divided into a number of subreaches, each being considered uniform in geometry and in other factors. The basic method of characteristics using specified time intervals is applied to each subreach, and additional boundary conditions are imposed at the junctions between subreaches. For the user's convenience, the program incorporates several types of options covering input, accuracy, boundary conditions, data formats, output, and continuation. The program accepts input data in three forms—data cards only, cards and user-supplied subroutines, and cards and disk stage data. Boundary values are either stage or velocity and are given either in numerical data or equation form. The user may employ or bypass the extrapolation procedures by weighing the trade-off between accuracy and computer time. By eight output options provided in the program, he can also tailor the outputs to suit his need. (Woodard-USGS) W77-09993

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1976 WATER YEAR, Geological Survey, Little Rock, Ark. Water Resources Div. For primary bibliographic entry see Field 7C. W77-09997

COMPUTATION OF RECORDS OF STREAM-FLOW AT CONTROL STRUCTURES, Geological Survey, Bay Saint Louis, Miss. Water Resources Div. D. L. Collins. Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 666. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 77-8, April 1977. 57 p, 13 fig, 9 tab, 5 ref.

Descriptors: *Streamflow, *Flow rates, *Control structures, *Equations, *Discharge coefficient, Methodology, Instrumentation, Hydraulic structures, Hydraulic turbines, Locks, Spillway gates, Automation, Computer programs, Hydrologic data, Manometers, Leakage. Identifiers: *Streamflow computations.

Traditional methods of computing streamflow records on large, low-gradient streams require a continuous record of water-surface slope over a natural channel reach. This slope must be of sufficient magnitude to be accurately measured with

available stage measuring devices. On highly regulated streams, this slope approaches zero during periods of low flow and accurate measurement is difficult. Methods are described to calibrate multipurpose regulating control structures to more accurately compute streamflow records on highly regulated streams. Hydraulic theory, assuming steady, uniform flow during a computational interval, is described for five different types of flow control. The controls are: Tainter gates, hydraulic turbines, fixed spillways, navigation locks, and crest gates. Detailed calibration procedures are described for the five different controls as well as for several flow regimes for some of the controls. The instrumentation package and computer programs necessary to collect and process the field data are discussed. Two typical calibration procedures and measurement data are presented to illustrate the accuracy of the methods. (Woodard-USGS) W77-10003

APPLICATION OF THE U.S. GEOLOGICAL SURVEY RAINFALL RUNOFF SIMULATION MODEL TO IMPROVE FLOOD-FREQUENCY ESTIMATES ON SMALL TENNESSEE STREAMS, Geological Survey, Nashville, Tenn. Water Resources Div. For primary bibliographic entry see Field 2A. W77-10004

VARIATION OF WIDTH AND DISCHARGE FOR NATURAL HIGH-GRADIENT STREAM CHANNELS, Geological Survey, Lawrence, Kans. Water Resources Div. W. R. Osterkamp, and E. R. Hedman. Water Resources Research, Vol 13, No 2, p 256-258, April 1977. 1 fig, 1 tab, 13 ref.

Descriptors: *Streamflow, *Estimating, *Channel morphology, *Width, *Gradients(Streams), Analytical techniques, Equations, Regression analysis. Identifiers: *High-gradient streams, *Stream width-discharge relationship.

Standardized measurements of width at gaging stations on high-gradient stream channels show that a power function relation, indicative of static allometric growth, exists between width and average discharge in the downstream direction. Results are in close agreement with studies by Leopold and Maddock (1953) and confirm their 'b' exponent. Workers currently using active channel width measurements as a means of estimating average discharge from ungaged basins should consider 2.0 as a standard exponent of the regression relation. (Woodard-USGS) W77-10009

SMALL CATCHMENT FLOOD MODELLING, South African Dept. of Water Affairs, Pretoria. Div. of Hydrology. D. W. Cousins, and J. R. Burney. Water SA, Vol. 2, No. 4, p 150-155, October 1976. 2 fig, 4 hydrographs, 1 tab, 7 ref.

Descriptors: *Mathematical models, *Watersheds(Basins), Accuracy, Hydrographs, Model studies, Test procedures, Statistical models, Runoff, Computers, Rainfall, *Flood forecasting, Africa. Identifiers: South Africa.

An accurate simulation model for small catchments influenced by variation in rainfall intensity is necessary in the design of hydrologic structures in South Africa. Two simulation techniques were tested and compared: the Huggins model and the synthetic hydrograph model. A correlation was found between inherent sensitivity and the amount of cost and work involved to achieve the desired solution. (So African Water Info Center)

W77-10083

ON THE APPLICATION OF TREND SURFACES OF PRECIPITATION TO MOUNTAINOUS AREAS, Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering. For primary bibliographic entry see Field 2B. W77-10088

FURTHER IMPORTANT FEATURES OF THE FISH FAUNA OF THE CLANWILLIAM OLIFANTS RIVER SYSTEM, SOUTHWESTERN CAPE, Albany Museum, Grahamstown (South Africa). R. A. Jubbe. Piscator, No. 92, p 154-157, December 1975. 2 fig, 9 ref.

Descriptors: *Freshwater fish, Fish barriers, Fish migration, River systems, Predator-prey relationships, Africa. Identifiers: Barbus erubescens, Barbus calidus, Oreodaimon quantlambae, Kneria auriculata, Barbus trunensis, *Olifants River, Treur River, Blyde River, South Africa.

Research work in the field and in the laboratory by the ichthyologist of the Albany Museum, Mr. P. Skelton, has resulted in the discovery of yet another endemic Barbus species in the catchment of the Clanwilliam Olifants River. The new species is named Barbus erubescens. A description of taxonomic characters is supplied. (So African Water Info Center) W77-10090

2F. Groundwater

AN ELECTRIC ANALOG AND DIGITAL COMPUTER MODEL OF THE CHIPUXET GROUND WATER AQUIFER, KINGSTON, RHODE ISLAND, Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering. D. Geisser.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 251. Price codes: A08 in paper copy, A01 in microfiche. M.S. Thesis, 1975. 149 p, 51 fig, 11 tab, 29 ref, 2 append. OWRT A-056-RI(1), 14-31-0001-5040.

Descriptors: *Aquifers, Analog computers, Digital computers, *Rhode Island, *Model studies, *Computer models, *Groundwater resources, Simulation analysis. Identifiers: *Chipuxet aquifer(RI).

The goal was to develop a simulation model of the Chipuxet River Aquifer. This model was used to study the availability of ground water in the Chipuxet River Aquifer and in particular, to assist the Rhode Island State Water Resources Board in the selection of an optimal pumping scheme proposed for the area. Two criteria for selecting the optimum pumping scheme were the desire to minimize (1) the effect of proposed pumping on the areas' water table configuration, and (2) its effect on the discharge in the Chipuxet River. Modeling of the Chipuxet Modeling of the Chipuxet River was accomplished through the use of both electric analog and digital computer techniques. With the electric analog, it was possible to simulate the flow of water within the aquifer electrically. Using the digital computer, it was possible to describe the flow of water within the aquifer mathematically. This investigation revealed that a pumping scheme which concentrated the pumping in the vicinity of 30 Acre Pond was optimal. It also revealed that none of the proposed pumping schemes appear to have any acceptable effects on either the areas' water table configuration or the discharge in the Chipuxet River. Finally, this investigation resulted in the development of two

Field 2—WATER CYCLE

Group 2F—Groundwater

working models of the Chipuxet River Aquifer which can be utilized during future investigations of the ground water in the area.
W77-09637

DRAIN SPACING BASED ON DYNAMIC EQUILIBRIUM,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
D. B. McWhorter.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 103, No. IR2, Proceedings Paper 13022, p 259-271, June 1977. 3 fig, 4 tab, 13 ref, 2 append.

Descriptors: *Drains, *Water table, *Groundwater movement, *Mathematical models, Equations, Aquifers, Groundwater recharge, Hydraulic properties, Flow, Depth, Discharge(Water), Saturated flow, Drawdown, Boundaries(Surfaces).
Identifiers: *Spacing(Drains), Parallel drains, Boussinesq equations, Drainout, Superposition.

Superposition was used to obtain an equation for the water table elevation between parallel drains in response to a periodic sequence of instantaneous recharge events of arbitrary volume and timing. The mathematical developments are especially useful for calculating the spacing of parallel-relief drains required to achieve a prescribed maximum water table elevation under conditions of 'dynamic equilibrium.' A drain-spacing calculation, compared with the results obtained by the Bureau of Reclamation's (USDI) approximate, dynamic-equilibrium method, showed the latter to result in a drain spacing that is on the safe side. The spacing method reported herein provides a mathematically correct alternative to the pioneering dynamic equilibrium calculation and maintains the flexibility required to handle conditions of variable recharge and drainout times. (Visocky-ISWS)
W77-09698

GROUND-WATER RESOURCES OF THE LEXINGTON, KENTUCKY, AREA,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-09996

SELECTED WATER-LEVEL RECORDS FOR WESTERN OKLAHOMA, 1975-1976,
Geological Survey, Oklahoma City, Okla. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09998

GROUND-WATER LEVELS IN OBSERVATION WELLS IN OKLAHOMA, 1975,
Geological Survey, Oklahoma City, Okla. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09999

ANNUAL WATER-RESOURCES REVIEW WHITE SANDS MISSILE RANGE, 1976 - A BASIC-DATA REPORT,
Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10005

A METHOD OF ESTIMATING PARAMETERS AND ASSESSING RELIABILITY FOR MODELS OF STEADY STATE GROUNDWATER FLOW 1. THEORY AND NUMERICAL PROPERTIES,
Geological Survey, Lakewood, Colo. Water Resources Div.
R. L. Cooley.
Water Resources Research, Vol 13, No 2, p 318-324, April 1977. 1 fig, 37 ref.

Descriptors: *Model studies, *Groundwater movement, *Least squares method, *Steady flow, Numerical analysis, Aquifer characteristics, Hydrogeology, Geohydrologic units, Boundary layers, Sinks, Methodology, Forecasting, Regression analysis.

A new nonlinear least squares solution for the hydrogeologic parameters, sources and sinks, and boundary fluxes contained in the equations approximately governing two-dimensional or radial steady state groundwater motion was developed through use of a linearization and iteration procedure applied to the finite element discretization of the problem. Techniques involving (1) use of an iteration parameter to interpolate or extrapolate the changes in computed parameters and head distribution at each iteration and (2) conditioning of the least squares coefficient matrix through use of ridge regression techniques were proven to induce convergence of the procedure for virtually all problems. Because of the regression nature of the solution for the parameter estimation problem, classical methods of regression analysis are promising as an aid to establishing approximate reliability of computed parameters and predicted values of hydraulic head. Care must be taken not to compute so many parameters that the stability of the estimates is destroyed. Reduction of the error variance by adding parameters is desirable provided that the number of degrees of freedom for error remains large. (Woodard-USGS)
W77-10008

GEOHYDROLOGY OF MUSCATINE ISLAND, MUSCATINE COUNTY, IOWA,
Geological Survey, Iowa City, Iowa. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10012

FLUCTUATIONS OF GROUND-WATER LEVELS IN LEE COUNTY, FLORIDA, IN 1975 WATER YEAR,
Geological Survey, Tallahassee, Fla. Water Resources Div.
T. H. O'Donnell.
Open-file report 76-854, 1977. 77 p, 60 fig, 7 tab, 3 ref.

Descriptors: *Groundwater, *Water level fluctuations, *Observation wells, *Aquifer characteristics, *Florida, Data collections, Pumping, Groundwater recharge, Rainfall, Artesian aquifers, Water table aquifers, Hydrographs.
Identifiers: *Lee County(Fla).

During the 1975 water year, rainfall was about average at Page Field, Florida, and from 20-25 percent below average at Lehigh Acres and Sanibel Island. Water levels were monitored in 57 observation wells in Lee County, Florida. Of the 23 wells that tap the water-table aquifer, one record high and 5 record low water levels were established. Record low water levels were established in 5 of 20 wells that tap the sandstone aquifer and in 1 of 10 wells that tap the upper Hawthorn aquifer. A record high water level was established in 1 of 3 wells that tap the lower Hawthorn aquifer. (Woodard-USGS)
W77-10014

ELECTRICAL WATER PROSPECTING.
Council for Scientific and Industrial Research, Pretoria (South Africa). Geophysics Div.
Scientiae, Vol. 16, No. 4, p 22-23, August 1975. 1 fig.

Descriptors: Geomorphology, Geophysics, Groundwater, *Resistivity, Electrodes, Water resources, Aquifers, Boreholes, Droughts, *Exploration, *Water sources, Africa.
Identifiers: Hereroland, South West Africa, Southern Africa.

The use of geoelectrical soundings to find water in arid Hereroland in the North of South West Africa is described. Work is directed at improving the siting of useful boreholes, which had previously achieved a success rate of only about 30% in this area. Principles of the resistivity method are explained, and the conformation of water-bearing layers in Hereroland is illustrated. As the regional geo-electrical survey progresses, it should be possible to delineate promising areas for borehole siting. Electrical resistivity might also indicate the quantity of groundwater available at a given site. (So. African Water Info. Center)
W77-10100

2G. Water In Soils

AN AUTOMATIC SCANNING APPARATUS FOR GAMMA SPECTROMETRY FOR THE DETERMINATION OF THE MOISTURE CONTENT IN SOIL COLUMNS, (IN DUTCH),
H. Verplanck, and M. De Boord.
Meded Fac Landbouwwet Rijksuniv Gent 39(1), p 121-133, 1974.

Descriptors: *Spectrophotometry, *Moisture content, *Automation, Equipment, Measurement, *Soil moisture meters.

An automatic column scanner was built with the following criteria in mind: Restriction of the measurement to a slice 5 mm in thickness. Location of the slice with an accuracy within 0.1 mm. The possibility of scanning 1 m-long columns. Free choice of the column orientation in the gravity field, e.g., vertical and horizontal. Radial rotation of the column to reduce gravity influences on horizontal flow. Possibilities for water supply at both ends of the column. Stepwise determination of the moisture content in the column with adjustable counting time per position together with an adjustable selection of the measurement location. Preadjustment of the trajectory of scanning and automatic recycling timing.—Copyright 1976, Biological Abstracts, Inc.
W77-09613

DETERMINATION OF HYDRAULIC PARAMETERS TO ESTIMATE WATER MOVEMENT AND WATER STORAGE IN UNDISTURBED SOIL: COMPARISON OF FIELD AND LABORATORY METHODS, (IN GERMAN),
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
H. Fluehler, P. Germann, F. Richard, and J. Leuenberger.
Z Pflanzenernahr Bodenkd 3, p 329-342, 1976.

Descriptors: *Water storage, *Soil water movement, *Soil moisture, Tensiometers, Hydraulic conductivity, *Moisture content, Drainage, Loess, *Neutron meters.

In an undisturbed soil monolith in continuous connection with the underlying loess soil layer 60 tensiometer and a neutron probe-access tube were used, respectively, to determine the matric potential and water content changes during a transient drainage experiment. Within the matric potential range of 0 to approximately -50 to -100 mbar the soil moisture characteristics determined in the laboratory and in the field were substantially indifferent. When the matric potential was more negative than -100 mbar the slope of these curves and hence of the specific moisture capacities were comparable. The field-measured conductivity functions differed considerably from those values which were measured under laboratory conditions or computed from the soil moisture characteristic data. The conductivities were expressed as a function of the matric potential which was possibly the major reason for these differences. However, the changes in water content in this dense silty clay loam were too small to express the unsaturated conductivity as a function of the absolute water

content. The most serious problems in extrapolating the results of the less time consuming labor calculation methods to field conditions arise in that range of matric potentials where water movement is significant.—Copyright 1977, Biological Abstracts, Inc.
W77-09624

INFLUENCES OF SOME PEAT SOIL FEATURES ON THE CAPILLARY WATER SUPPLY, (IN GERMAN),
Ausseninstitut fuer Moorforschung und Angewandte Bodenkunde, Bremen (West Germany).
W. Burghardt.
Z Pflanzenernaehr Bodenkd 3, p 343-355, 1976.

Descriptors: *Capillary water, Water supply, *Peat, Grasses, Drought resistance, *Soil profiles, *Bogs, Decomposing organic matter, *Pore pressure, *Fen.
Identifiers: *Weisse Moor (West Germany).

In the Weisse Moor near Gifhorn (West Germany) the grassland suffered in summer 1972 from extreme drought, on peat soil profiles with a thin top layer of moderately decomposed high bog over layers of slightly decomposed transition forms from bog to fen. This transition peat form was marked by the nature of its pores. This probably led to the considerable reduction of the unsaturated water flow. The capillary water supply of the grassland from saturated deeper peat layers (30 cm) was limited.—Copyright 1977, Biological Abstracts, Inc.
W77-09626

DEGRADATION OF A NONIONIC SURFACTANT IN SOILS AND PEAT,
California Univ., Riverside. Dept. of Soil Physics.
For primary bibliographic entry see Field 5B.
W77-09638

INFLUENCE OF CATION CONTENT ON THE BIOLOGICAL ACTIVITY OF FENSULFOTHION IN PLAINFIELD SAND,
Department of Agriculture, London (Ontario).
Research Inst.
C. R. Harris, and B. T. Bowman.
Soil Science Society of America Journal, Vol. 40, No. 3, p 385-389, May-June 1976. 2 fig, 1 tab, 39 ref.

Descriptors: *Cations, *Cation adsorption, *Insecticides, Soils, Soil investigations, Toxicity, *Bioassay, *Sands, Soil treatment.
Identifiers: *Crickets, *Fensulfuthion.

A study was conducted to assess the influence of cations on the biological activity of the organophosphorus insecticide, fensulfuthion in soil. Bioassays were done using first stage crickets as test insects and a Plainfield sand without and amended with various concentrations of reagent chloride salts of NH_4^+ , K^+ , Ca^{2+} , Fe^{3+} , and Al^{3+} . The toxicity of fensulfuthion decreased with increasing cation content, with the effect being most pronounced with trivalent > divalent > monovalent cations. Results of the bioassay study paralleled those of an earlier adsorption study on fensulfuthion-cation montmorillonite suspensions. (Skogerboe-Colorado State)
W77-09639

SULFUR-COATED FERTILIZERS FOR SUGARCANE: I. PLANT RESPONSE TO SULFUR-COATED UREA,
Florida Univ. Belle Glade. Dept. of Plant Nutrition.
For primary bibliographic entry see Field 3F.
W77-09640

SULFUR-COATED FERTILIZERS FOR SUGARCANE: II. RELEASE CHARACTERISTICS OF SULFUR-COATED UREA AND KCl ,
Florida Univ. Belle Glade. Dept. of Plant Nutrition.
For primary bibliographic entry see Field 3F.
W77-09641

AMMONIA VOLATILIZATION AND NITROGEN UTILIZATION FROM SULFUR-COATED UREAS AND CONVENTIONAL NITROGEN FERTILIZERS,
Texas A and M Univ., Corpus Christi. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 3F.
W77-09642

EFFECT OF PRETREATMENT ON LOSS OF NITROGEN-15-LABELLED FERTILIZER NITROGEN FROM WATERLOGGED SOIL DURING INCUBATION,
Prairie View A and M Coll., Tex.
E. McKenzie, Jr., and L. T. Kurtz.
Soil Science Society of America Journal, Vol. 40, No. 4, p 534-537, July-August 1976. 1 fig, 3 tab, 27 ref.

Descriptors: *Denitrification, *Nitrogen, *Incubation, Soil chemistry properties, Soil tests, Soil investigations, Soils, Nutrients, *Soil treatment, *Fertilizers, Fertilization.
Identifiers: *Nitrogen-15 loss (Soil samples).

Soil preparation treatments (field-moist, intact cores; oven-dried, intact cores; and oven-dried, crushed, screened soil) greatly influenced fertilizer nitrogen loss under waterlogged conditions in the laboratory. Nitrogen (300 pp2m) as N-15-labelled calcium nitrate was added to samples from selected horizons of Drummer silty clay loam and they were subsequently covered with water and incubated for 0, 4, 8, 16, and 32 days. Samples of upper (above 51 cm) soil horizons were incubated at 21°C while those from deeper horizons were incubated at 18°C. Oven-drying and crushing of the soil during preparation increased fertilizer nitrogen loss. Only 34% of the fertilizer nitrogen disappeared from field-moist, intact soil cores while approximately 90% disappeared from both oven-dried, intact cores and crushed screened samples. Maximum rate of denitrification of fertilizer nitrogen in field-moist, intact cores was 3.58% of the applied nitrogen per day. This rate was approximately one-third of that in the oven-dried, intact cores and one-ninth of that in the oven-dried, crushed samples. (Skogerboe-Colorado State)
W77-09643

PICLORAM DEGRADATION IN SOILS AS INFLUENCED BY SOIL WATER CONTENT AND TEMPERATURE,
Agricultural Research Service, Fort Collins, Colo.
For primary bibliographic entry see Field 5B.
W77-09644

NITRITE DECOMPOSITION IN FLOODED SOIL UNDER DIFFERENT PH AND REDOX POTENTIAL CONDITIONS,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
O. Van Cleemput, W. H. Patrick, Jr., and R. C. McIlhenny.
Soil Science Society of America Journal, Vol. 40, No. 1, p 55-60, January-February 1976. 4 fig, 3 tab, 32 ref.

Descriptors: Soils, *Soil investigations, Soil properties, *Soil chemistry, *Nitrites, Sterilant, Soil sterilants, *Oxidation reduction potential, Hydrogen ion concentration.
Identifiers: *Nitrite decomposition (Soils), *Flooded soils.

Nitrite decomposition products were studied in a flooded soil suspension maintained under different pH and redox potential conditions. The effect of a sterilant, HgCl₂ on nitrite breakdown was also investigated. Soil suspensions were incubated for several days with the pH maintained at 4.5, 6, and 8 and the redox potential maintained at 0 and +200 mV. Nitrite was then added to the suspensions and the decomposition products were determined by mass spectrometry. Under acid conditions significant amounts of N₂ and nitrogen oxide gases (N₂O, NO) were formed in both the moderately reduced (+200 mV) and reduced (0 mV) suspensions. At higher pH's the nitrite reduction rate was slightly less and the amounts of nitrogen oxide gases formed were considerably less with N₂ being the major product. The chemical sterilant decreased the conversion of nitrite to N₂ and markedly increased the formation of NO. The significant production of NO under acid conditions both with and without the sterilant, suggest the likelihood of self-decomposition of nitrous acid as a major mechanism of nitrite loss. (Skogerboe-Colorado State)
W77-09645

EVALUATION OF THE PARAMETERS OF SOIL PHOSPHORUS AVAILABILITY FACTORS IN PREDICTING YIELD RESPONSE AND PHOSPHORUS UPTAKE,
University of New England, Armidale (Australia).
Dept. of Agronomy and Soil Science.
R. C. Dalal, and E. G. Hallsworth.
Soil Science Society of America Journal, Vol. 40, No. 4, p 541-546, July-August 1976. 1 fig, 5 tab, 37 ref.

Descriptors: *Phosphorus, Nutrients, Crop production, *Crop response, Wheat, Evaluation, Soils, *Absorption, Forecasting.
Identifiers: *Phosphorus uptake (Soils).

The importance of quantity, intensity, capacity, and rate factors of soil P availability to account quantitatively for the variation in P uptake and wheat grain yield in pot and field experiments was studied. Among the parameters of the quantity factor, L value was found to be highly correlated with P uptake at 35 and 150 days after planting (maturity) when all the soils were considered. However, the carbonate P was found to be the best parameter of the quantity factor when the soils containing high amounts of hematite/goethite were excluded. The parameters of the intensity factor were significantly correlated with P uptake at the later stage (150 days). The rate factor, as measured by AER was better correlated with P uptake at 35 days than with P uptake at 150 days after planting. The quantity factor as measured by the carbonate P accounted for 75 and 93% of the variation in P uptake and grain yield, respectively. The capacity factor, Mb when combined with the quantity factor accounted for more of the variation in P uptake (150 days) from 75 to 86%. The intensity and the rate factors had a smaller effect. (Skogerboe-Colorado State)
W77-09646

DISTRIBUTION OF PLUTONIUM IN TRINITY SOILS AFTER 28 YEARS,
Los Alamos Scientific Lab., N. Mex.
For primary bibliographic entry see Field 5B.
W77-09647

MICROBIAL FORMATION OF VOLATILE SELENIUM COMPOUNDS IN SOIL,
Cornell Univ. Agricultural Experiment Station, Ithaca, N. Y. Dept. of Agronomy.
J. W. Doran, and M. Alexander.
Soil Science Society of America Journal, Vol. 40, No. 5, p 687-690, September-October 1976. 3 fig, 2 tab, 18 ref.

Descriptors: *Selenium, Soils, Soil investigations, *Soil chemistry, Soil properties, Microbiology,

Field 2—WATER CYCLE

Group 2G—Water In Soils

*Pollutant identification, Gas chromatography, Mass spectrometry.
Identifiers: *Microbial formation(Soils).

Selenium was volatilized from soils amended with elemental Se, selenite, selenate, trimethyl-selenonium chloride, selenomethionine, and selenocystine and incubated in air or anaerobically. The processes were wholly or largely the result of microbial action. The conversion of selenite and selenate to volatile products was enhanced if soil was amended with organic materials. Indigenous soil Se was also volatilized in the presence of supplemental organic matter. The products were identified by combined gas chromatography-mass spectrometry. Dimethyl selenide was generated from all Se compounds tested when amended soils were incubated in the presence of air. Under anaerobic conditions, dimethyl selenide was produced from the three organic Se compounds and selenate, and a product tentatively identified as hydrogen selenide (H₂Se) was evolved from soil receiving elemental Se, selenite, selenate, or selenocystine. Dimethyl diselenide was also formed from selenomethionine in soil incubated in air or anaerobically. (Skogerboe-Colorado State)
W77-09648

PREDICTING 2,4,5-T MOVEMENT IN SOIL COLUMNS,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 5B.
W77-09649

COMMENTS ON NITRATE REDUCTION IN UNSATURATED SOIL,
California Univ., Berkeley. Dept. of Soil Biology.
A. D. McLaren.
Soil Science Society of America Journal, Vol. 40, No. 5, p 698-699, September-October 1976. 1 fig, 12 ref.

Descriptors: *Nitrites, *Nitrates, Ions, Soils, Soil investigations, Nitrification, Kinetics, Microbiology.
Identifiers: *Soil nitrites, Microbial ecology, *Nitrate reduction(Soils), *Unsaturated soils.

Cyclic oxidation and reduction of nitrite and nitrate in soil are analyzed in terms of first- and zero-order microbial kinetic reactions, respectively. A reversible reaction step involving these ions can account for a low, but constant concentration of nitrate in an unsaturated field soil for long periods or for considerable depths in a laboratory soil column. (Skogerboe-Colorado State)
W77-09650

ADSORPTION OF DODECYLBENZENE SULFONATE ON Na(+)-MONTMORILLONITE: EFFECT OF SALT IMPURITIES,
Chevron Oil Field Research Co., La Habra, Calif.
D. M. Clementz, and J. L. Robbins.
Soil Science Society of America Journal, Vol. 40, No. 5, p 663-665, September-October 1976. 1 fig, 12 ref.

Descriptors: *Adsorption, *Montmorillonite, Surfactants, Anion exchange, *Clays, Salts, Sulfur compounds, *Sulfonates, Sodium, Ions.

The adsorption of purified dodecylbenzene sulfonate (ABS) on Na(+)-montmorillonite follows the Langmuir isotherm, reaching a maximum amount adsorbed which corresponds to the anion exchange capacity of the clay. When a commercial grade ABS is used, the adsorption process is more complex and occurs in two distinct steps. In dilute solutions, the salt impurity has a minor effect on adsorption and the result is essentially the same as that obtained for the purified surfactant. However, as the salt concentration is increased to a given value, enhanced adsorption due to

hemimicelle formation occurs. (Skogerboe-Colorado State)
W77-09651

CATION-EXCHANGE CAPACITY OF ACID SOILS USING ALUMINUM CHLORIDE AND BARIUM CHLORIDE-TRIETHANOLAMINE,
Klamath National Forest Yreka, Calif.
E. B. Alexander.

Soil Science Society of America Journal, Vol. 40, No. 6, p 961-963, November-December 1976. 1 tab, 6 ref.

Descriptors: Laboratory tests, *Cation exchange, Soil properties, *Soil tests, Soil investigations, *Acidic soils, *Chlorides, *Soil classification, Analytical techniques.

Base saturation is such an important criterion for classifying soils in the U.S. Soil Taxonomy that a procedure has been developed for scantily equipped field laboratories. Exchange acidity and cation-exchange capacity (CEC) are determined in sequence with the same samples. The procedure involved (i) displacement of exchangeable hydrogen and Al with BaCl₂-triethanolamine solution and back-titration with HCl to determine the exchange acidity, (ii) saturation with Al from AlCl₃ solution, (iii) removal of excess Al with water, (iv) displacement of Al with BaCl₂-triethanolamine solution and back-titration with HCl to determine the exchange capacity, and (v) estimation of basic cations by the difference between the CEC and the exchange acidity. This is an extension of a well-established procedure for determining exchange acidity. The CEC results compare closely with the sums of cations for acid subsoils, but are low for Al horizons with much organic matter. (Skogerboe-Colorado State)
W77-09652

SIMULTANEOUS TRANSPORT OF NITRATE AND GASEOUS DENITRIFICATION PRODUCTS IN SOIL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W77-09653

SOIL TEMPERATURES AND HEAT LOSS FOR A HOT PIPE NETWORK BURIED IN IRRIGATED SOIL,
Energy Resources Co., Cambridge, Mass.
For primary bibliographic entry see Field 5D.
W77-09654

EFFECTS OF BORON AND NITROGEN ON GRAIN YIELD AND BORON AND NITROGEN CONCENTRATIONS OF BARLEY AND WHEAT,
Department of Agriculture, Charlottetown (Prince Edward Island). Research Station.
For primary bibliographic entry see Field 3F.
W77-09655

PHOSPHORUS-ZINC INTERACTION IN RELATION TO ADSORPTION RATES OF PHOSPHORUS, ZINC, COPPER, MANGANESE, AND IRON IN CORN,
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.
For primary bibliographic entry see Field 3F.
W77-09656

CALCIUM AND STRONTIUM ABSORPTION BY CORN ROOTS IN THE PRESENCE OF CHELATES,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W77-09657

INFLUENCE OF IONIC STRENGTH AND INORGANIC COMPLEX FORMATION ON THE ADSORPTION OF TRACE AMOUNTS OF CD BY MONTMORILLONITE,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W77-09658

CHEMICAL DISTRIBUTION AND GASEOUS EVOLUTION OF ARSENIC-74 ADDED TO SOILS AS DSMA-(74)AS,
Tennessee Univ., Knoxville. Dept. of Plant and Soil Science; and Tennessee Univ., Knoxville. Agricultural Experiment Station.
For primary bibliographic entry see Field 5B.
W77-09659

EFFECT OF LEACHING FRACTION ON RIVER SALINITY,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 5G.
W77-09697

DRAIN SPACING BASED ON DYNAMIC EQUILIBRIUM,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W77-09698

A LABORATORY MODEL TO INVESTIGATE THE SOIL MOISTURE CONDITIONS ON A DRAINING SLOPE,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, and T. P. Burt.
Journal of Hydrology, Vol 33, No 3/4, p 383-390, May 1977. 8 fig, 1 tab, 4 ref.

Descriptors: *Drainage, *Soil moisture, *Model studies, Laboratory tests, Flow, Streamflow, Laboratory equipment, Moisture, Moisture availability, Drains, Moisture content, Moisture meters, Drainage programs, Slopes, Soil water.
Identifiers: *Draining slopes, Flow mechanisms, Slope drainage, Low streamflow, Drainage model, Slope model.

A laboratory slope drainage model was constructed to test results obtained by Hewlett and Hibbert who suggested that unsaturated flow is the dominant flow mechanism at the later stages of drainage. The results from the model, together with hydraulic conductivity determinations, indicated the slope discharge to be controlled by saturated flow throughout drainage. The laboratory slope model consisted of a 4 m length of plastic guttering of 5.5 cm radius and was packed with sand and supported on a dexion frame at an angle of 20 deg. Tensiometers were placed at 5-cm intervals up the slope and connected to a scanivalve fluid switch and pressure transducer. The system enabled the rapid scanning of tension conditions over the slope, and the complete slope tensions could be monitored within one minute. Slope discharge was measured using a funnel and graduated cylinder placed below the base of the pipe. The small disparity between predicted discharge and observed discharge can be attributed to the difficulties in precisely measuring the water table slope and the extent of the saturated conditions above the water table. (Roberts-ISWS)
W77-09712

VIRUS AND BACTERIA REMOVAL FROM WASTE WATER BY RAPID INFILTRATION THROUGH SOIL,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
For primary bibliographic entry see Field 5D.
W77-09860

THE EFFECTS OF WATER CONTENT OF THE TOPSOIL ON MICRONUTRIENT AVAILABILITY AND UPTAKE IN A SILICEOUS SANDY SOIL.

Adelaide Univ. (Australia). Dept. of Agronomy.
 E. K. S. Nambiar.
 Plant and Soil, Vol 46, p 175-183, 1977. 4 tab, 12 ref.

Descriptors: *Soil water, *Topsoil, *Nutrients, *Absorption, Oats, Adsorption, Subsoil, Acidic soil, Sands, Soil-water-plant relationships, Planting management, Root development, Plant physiology, Drying, Manganese, Zinc, Copper, *Australia.
Identifiers: *Micronutrients, Root weight, Shoot weight.

Experiments were conducted in South Australia to determine the effects of topsoil water content on manganese, zinc and copper availability and their uptake by oats grown on a sandy soil. Topsoil water content significantly reduced root growth in that layer, but drying for up to 42 days had no significant effect on micronutrient concentrations in the shoots as long as water stress did not occur. Micronutrient application caused increases in shoot weight and subsoil root weight, while topsoil root weight declined. Applications of Mn, Zn and Cu did not increase concentrations of these elements in the shoot, whether soil was wet or dry. However, micronutrient concentrations in the root were increased by such application. The acidic, siliceous sand was surprisingly effective at rendering Mn, Zn and Cu unavailable; possible explanations for the results are given. The removal of micronutrients from the exchangeable pool, probably mediated by organic matter, was more important than fluctuations in soil water content. (Jahns-Arizona)
 W77-09930

SEEPAGE FROM SMALL EARTH DAMS,

Western Australia Dept. of Agriculture, South Perth.
 For primary bibliographic entry see Field 8D.
 W77-09932

THE NATURE OF CHANGES IN BULK DENSITY WITH WATER CONTENTS IN CRACKING CLAY.

Queensland Wheat Research Inst., Toowoomba (Australia). Primary Industries Dept.
 R. D. Berndt, and K. J. Coughlan.
 Australian Journal of Soil Research, Vol 15, p 27-37, 1976. 6 fig, 1 tab, 13 ref.

Descriptors: *Bulk density, *Moisture content, *Clays, *Interstices, *Shrinkage, Laboratory tests, Soil analysis, On-site investigations, Soil water, Drying, Soil properties, Soil mechanics.
Identifiers: Soil cores, Cracking clay.

Laboratory experiments were conducted in Queensland to determine the effect of changing water content on the bulk density of undisturbed cores of a cracking clay; results were compared with those from a field sampling of the same soil. Laboratory cores shrank three-dimensionally and normally within the water content range measured in the field soil; volume changes during drying were approximately 95% of those expected from normal shrinkage. Deviation from normal was attributed to small internal cracks and to structural shrinkage at high water contents. The swelling of supported cores was approximately three-dimensional, except for some unconfined swelling and disruption of the core surface. After unidimensional swelling was induced by confining dry cores to reduce the void ratio before wetting, shrinkage was three-dimensional, indicating reorientation of soil particles during the unidimensional swelling phase. Field data indicated unidimensional shrinkage at water contents above 0.47 g g⁻¹; these results were attributed to sampling inaccuracies from using a small-diameter core sampler, and the

actual bulk density relationship was considered three-dimensional. Bulk density variability is considerably greater at lower water contents. (Jahns-Arizona)
 W77-09937

AN EVALUATION OF TOTAL SOLAR REFLECTANCE AND SPECTRAL BAND RATIOING TECHNIQUES FOR ESTIMATING SOIL WATER CONTENT.

Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
 R. J. Reginato, J. F. Vedder, S. B. Idso, R. D. Jackson, and M. B. Blanchard.
 Journal of Geophysical Research, Vol. 82, No. 15, p 2101-2104, May 20, 1977. 5 fig, 12 ref.

Descriptors: *Remote sensing, *Soil moisture, *Solar radiation, *Arizona, Reflectance, Soils, Irrigation, *Moisture content, *Soil water, Microwaves, Radiation, Infrared radiation, Measurement, Drying, Soil science, Estimating, Evaluation.
Identifiers: Pyranometers, Multispectral scanners.

For several days in March of 1975, reflected solar radiation measurements were obtained from smooth and rough surfaces of wet, drying, and continually dry Avondale loam at Phoenix, Arizona, with pyranometers located 50 cm above the ground surface and a multispectral scanner flown at a 300-m height. The simple summation of the different band radiances measured by the multispectral scanner proved to be as good as the pyranometer data for estimating surface soil water content if the multispectral scanner data were standardized with respect to the intensity of incoming solar radiation or the reflected radiance from a reference surface, such as the continually dry soil. Without this means of standardization, multispectral scanner data are most useful in a spectral band ratioing context. The results indicated that, for the bands used, no significant information on soil water content could be obtained by band ratioing. Thus the variability in soil water content should insignificantly affect soil-type discrimination based on identification of type-specific spectral signatures. Therefore, remote sensing, conducted in the 0.4- to 1.0 micrometer wavelength region of the solar spectrum, would seem to be much more suited to identifying crop and soil types than to estimating of soil water content. (Sims-ISWS)
 W77-09957

AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM COMPOUNDS ON CALCAREOUS SOILS: V. SOIL WATER CONTENT AND METHOD OF NITROGEN APPLICATION.

Texas A and M Univ., El Paso. Agricultural Research Station.
 L. B. Fenn, and R. Escarzagua.
 Soil Science Society of America Journal, Vol 40, No 4, p 537-541, July-August 1976. 2 fig, 1 tab, 14 ref.

Descriptors: *Nitrogen, Fertilization, Nutrients, Temperature, Ammonia, Ammonium compounds, *Calcareous soils, *Soil water, Fertilizers.
Identifiers: *Ammonia-nitrogen.

Ammonia-nitrogen losses from soils were dependent on the existence of sufficient water for solubilization of the applied NH₄-compounds. Laboratory data revealed that NH₃ volatilization from (NH₄)₂SO₄ was greatly reduced on soils with 55% water at 12, 22 and 30 degrees C as compared to soils with 30% water. Ammonia-nitrogen losses were the highest at all temperatures and nitrogen application rates when soils contained 13 to 30% soil water. Dry NH₄-chemicals did not dissolve in soils with 0 and 8% soil water, therefore, little NH₃ was lost. Application of a concentrated (NH₄)₂SO₄ solution to soils with 8% water resulted in near maximum NH₃ loss. This same

solution, when applied to the surface of an oven dry soil, resulted in lower losses. Application of NH₄NO₃ to soils with 55% water resulted in lower NH₃ losses when compared to soils with 8 to 30% water. Soils with 0% water retained essentially all applied NH₄(+)-N whether applied in dry or concentrated liquid form. (See also W77-01515) (Skogerboe-Colorado State)
 W77-09960

THE INFLUENCE OF CATION EXCHANGE CAPACITY AND DEPTH OF INCORPORATION ON AMMONIA VOLATILIZATION FROM AMMONIUM COMPOUNDS APPLIED TO CALCAREOUS SOILS.

Texas A and M Univ., El Paso. Agricultural Research Station.
 L. B. Fenn, and D. E. Kissel.
 Soil Science Society of America Journal, Vol 40, No 3, p 394-398, May-June 1976. 2 fig, 3 tab, 15 ref.

Descriptors: *Cation exchange, *Calcareous soils, Soils, Soil properties, Soil investigations, Soil chemistry, Model studies, *Ammonium compounds.

The objective was to determine the influence of soil cation exchange capacity (CEC) and depth of incorporation on NH₃-N volatilization from NH₄(+)-N compounds applied to calcareous soil. This study was conducted in the laboratory on soils with a wide range of CEC. An increasing CEC resulted in decreasing NH₃ losses. Ammonium sulfate produced higher soil pH values and NH₃ losses than did NH₄NO₃. The pH of the soil decreased with increasing NH₄NO₃ application rates. With NH₄NO₃, percent NH₃(-)-N losses increased as the application rates increased. Incorporation of the NH₄(+)-compounds into the soil reduced NH₃ losses. Increasing depths of NH₄(+)-incorporation resulted in reduced NH₃ loss. Losses decreased as the CEC of soil increased. The effectiveness of soil depth in reducing NH₃ loss was associated with soil water content. Decreasing the soil water increased the effectiveness of soil incorporation for reducing NH₃ losses. (Skogerboe-Colorado State)
 W77-09961

RELEASE OF CADMIUM FROM CLAYS AND PLANT UPTAKE OF CADMIUM FROM SOIL AS AFFECTED BY POTASSIUM AND CALCIUM AMENDMENTS.

Ohio Agricultural Research and Development Center, Wooster.
 F. Haghir.
 Journal of Environmental Quality, Vol 5, No 4, p 395-397, October-December 1976. 2 tab, 11 ref.

Descriptors: *Cadmium, *Potassium, *Clays, *Calcium, Kaolinite, Illite, Soybeans, Heavy metals, *Soil amendments.
Identifiers: Cadmium sorption.

The effects of percent K and/or Ca saturation on the release of Cd from Cd-treated H-clays (kaolinite and illite) and on the Cd availability to plants from Cd-treated Canfield silt loam soil were determined. The concentration of Cd in the dialyzates from both kaolinite and illite clays increased as the percent Ca or K saturation of the clays in the suspension decreased. The release of Cd from both clays was greater in the presence of Ca than K. In a separate experiment, the concentration of Cd in soybean shoots (Glycine max L. Merr.) 'Corsoy' decreased with increasing percent Ca or K saturation of the soil. The results indicated that Cd uptake by soybean shoots could be impaired to a great extent by K application. (Skogerboe-Colorado State)
 W77-09962

Field 2—WATER CYCLE

Group 2G—Water In Soils

MICROBIAL POLYPHOSPHATES: FACTORS INFLUENCING THEIR ACCUMULATION, Ohio Agricultural Research and Development Center, Wooster.

I. L. Pepper, R. H. Miller, and C. P. Ghosikar. Soil Science Society of America Journal, Vol 40, No 6, p 872-875, November-December 1976. 2 fig, 5 tab, 8 ref.

Descriptors: *Phosphorus, *Soil chemistry, Soil properties, Soil investigations, *Phosphates, Inorganic compounds.

Identifiers: *Phosphorus solubilization(Soils), *Microbial inorganic polyphosphates.

Infrared spectra of microbially synthesized, acid labile, inorganic P compounds extracted from soils provided additional evidence that they are inorganic polyphosphates (poly P). Incubation studies with glucose amended soils demonstrated the transient nature of naturally occurring poly P. Experiments are reported on the conditions which optimize poly P synthesis in soil. A 2-week incubation period (preincubation) with a source of carbon (2% glucose or 4% straw) and a further 2-day incubation period (postincubation) after adding a source of ortho P resulted in the maximum accumulation of poly P. The quantity of poly P also increased with increasing rates of orthophosphate from none to 1,000 micro g soil/g. Longer periods of postincubation reduced poly P accumulation. Poly P synthesis was greater when relatively insoluble sources of P were added to soils and accumulation followed the order: $\text{FePO}_4 \cdot 2\text{H}_2\text{O} > \text{rock phosphate} > \text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O} > \text{KH}_2\text{PO}_4$. The results suggest that poly P synthesis may accompany P solubilization in soils and be an integral part of the soil P cycle. (Skogerboe-Colorado State)

W77-09965

AMMONIUM DIFFUSION AS A FACTOR IN NITROGEN LOSS FROM FLOODED SOILS, Louisiana State Univ., Baton Rouge. Dept. of Agronomy.

For primary bibliographic entry see Field 5B. W77-09966

EXTRACTION OF SOIL WATER USING CELLULOSE-ACETATE HOLLOW FIBERS, Oak Ridge National Lab., Tenn.

D. R. Jackson, F. S. Brinkley, and E. A. Bondietti. Soil Science Society of America Journal, Vol 40, No 2, p 327-329, March-April 1976. 5 fig, 1 tab.

Descriptors: *Soil water, Soils, *Soil investigation, Soil properties, Soil chemistry, Laboratory tests, Sampling, Greenhouses, Permeability.

Identifiers: *Hollow fibers(Cellulose-acetate), Soil columns.

Cellulose-acetate hollow fibers were used to extract soil solutions from soil columns. The fibers have unique characteristics of small diameter and high flexibility and permeability which are ideally suited for use in soils. Two experiments were completed to demonstrate the usefulness of the hollow fibers. A ^{109}Cd -tagged soil column was leached with distilled water, and subsequently soil water was extracted with the fibers. The effective radius of soil-water extraction by the fibers was evaluated. The results show that the fibers can extract soil solution for chemical assay at moisture levels ranging from 20 to 50%. Applications of this technique include sampling soil solution from greenhouse pots and experimental microcosms. (Skogerboe-Colorado State)

W77-09967

COMPARISON OF FIVE KINETIC MODELS FOR ORTHOPHOSPHATE REACTIONS IN MINERAL SOILS,

Robert S. Kerr Environmental Research Lab., Ada, Okla.

C. G. Enfield, C. C. Harlin, and B. E. Bledsoe.

Soil Science Society of America Journal, Vol 40, No 2, p 243-249, March-April 1976. 3 fig, 2 tab, 31 ref.

Descriptors: *Kinetics, Soils, Soil investigation, Soil properties, Soil chemical properties, Adsorption, Diffusion, Sorption, *Model studies, *Phosphates, *Soil chemistry.

Identifiers: *Orthophosphates, Mineral soils, *Kinetic models(Soils).

The kinetics of orthophosphate sorption with 25 mineral soils have been experimentally measured under laboratory conditions. The 25 mineral soils represent a wide range of physical and chemical properties. Regression analyses have been performed fitting the experimental data to five kinetic models. The five kinetic models include: a linearized first-order sorption, a first-order Freundlich sorption, an empirical function, a diffusion-limited Langmuir sorption, and a diffusion-limited Freundlich sorption. Mean correlation coefficients of 0.81, 0.83, 0.84, 0.86, and 0.88 were obtained for the models, respectively. (Skogerboe-Colorado State)

W77-09968

INFLUENCE OF LONG TERM TILLAGE, CROP ROTATION, AND SOIL TYPE COMBINATIONS ON CORN YIELD, Ohio Agricultural Research and Development Center, Wooster. Dept. of Agronomy and Agricultural Engineering.

For primary bibliographic entry see Field 3F. W77-09969

COMPUTER SIMULATION OF PHOSPHORUS MOVEMENT THROUGH SOILS, New Hampshire Univ., Durham. Inst of Natural and Environmental Resources.

For primary bibliographic entry see Field 5B. W77-09970

ESTIMATION OF COMPONENTS OF SOIL CATION EXCHANGE CAPACITY FROM MEASUREMENTS OF SPECIFIC SURFACE AND ORGANIC MATTER,

University Coll., Dublin (Ireland). Dept. of Soil Science.

D. Curtain, and G. W. Smillie.

Soil Science Society of America Journal, Vol 40, No 3, p 461-462, May-June 1976. 3 tab, 14 ref.

Descriptors: *Cation exchange, *Organic matter, Soil textures, Soils, Soil properties, Soil investigations, *Pollutant identification.

Identifiers: *Specific surface measurement(Soils), *Ireland.

Cation exchange capacities of Irish soils developed from a wide range of parent materials were found to be highly correlated with organic matter content and specific surface but not with clay content. Multiple regression analysis showed that organic matter in combination with specific surface accounted for 97% of the variation in CEC whereas organic matter and clay content only accounted for 58% of the variation. The better correlation between CEC and specific surface than between CEC and clay content, is attributed to the ability of surface area measurements to reflect the presence of phyllosilicates in silt and sand fractions of soils and to the fact that these minerals have less variable surface charge densities than cation exchange capacities. It is proposed that specific surface provides a better estimate than clay content of the mineral component of CEC for soils of varying mineralogy. (Skogerboe-Colorado State)

W77-09971

POTASSIUM SOURCES AND AVAILABILITY ON A DEEP, SANDY SOIL OF EAST TEXAS, Texas A and M Univ., College Station. Dept. of Soil Mineralogy.

F. M. Hons, J. B. Dixon, and J. E. Matocha.

Soil Science Society of America Journal, Vol 40, No 3, p 370-373, May-June 1976. 2 fig, 4 tab, 28 ref.

Descriptors: *Potassium, Nutrients, *Soil properties, *Bermuda grass, Soil investigations, Soil profiles, Fertilization, Root development, *Sands, *Texas, Coasts.

Identifiers: Mica, Darco soils.

Soil properties were assessed that may have contributed to the failure of Coastal bermudagrass to respond to application of K on Darco fine sand for 5 consecutive years. The depth to which plant roots absorbed K was assessed by field observation and by determination of K levels in control and treatment plots. Potassium minerals were determined by chemical methods to assess potential nutrient sources. Potassium removal was indicated to at least 160 cm by soil solution content and to 235 cm by exchangeable K concentration and Gapon selectivity values. Depth of bermudagrass rooting was in agreement with chemical indicators of K removal. (Skogerboe-Colorado State)

W77-09972

RELATION BETWEEN THE KINETICS OF NITROGEN TRANSFORMATION AND BIOMASS DISTRIBUTION IN A SOIL COLUMN DURING CONTINUOUS LEACHING, Connecticut Agricultural Experiment Station, New Haven.

J. L. Starr, and J. Y. Parlange.

Soil Science Society of America Journal, Vol 40, No 3, p 458-460, May-June 1976. 1 fig, 5 ref.

Descriptors: *Nitrogen, *Leaching, *Kinetics, Microorganisms, Soils, Soil investigations, *Biomass, *Distribution.

Identifiers: Soil columns, Microbes.

Nitrogen concentration profiles in soil columns with associated microbial distributions have been used in the past to deduce the kinetics of nitrogen transformations during steady leaching. Owing to the many factors which control microbial reaction kinetics in continuous flow systems, the effect of biomass variation and order of reaction cannot be separated by simply measuring steady-state concentrations profiles. It is shown that in practice these measurements only lead to some average kinetics for the system observed, even when the microbe distribution is measured independently. Previously published experimental data in conjunction with a derived expression are used to illustrate the point. (Skogerboe-Colorado State)

W77-09973

SAMPLING THE UNSATURATED ZONE OF IRRIGATED LANDS FOR RELIABLE ESTIMATES OF NITRATE CONCENTRATIONS,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

J. M. Ribbe, P. A. Nash, P. F. Pratt, and L. J. Lund. Soil Science Society of America Journal, Vol 40, No 4, p 566-570, July-August 1976. 5 fig, 5 tab, 9 ref.

Descriptors: *Nitrates, *Nitrogen, Soils, Soil properties, Soil investigations, *Sampling, *Irrigated lands, Root zone, Estimating, Water pollution sources.

Identifiers: Soil variability, *Nitrate-nitrogen concentrations(Soils).

Data from a study of 56 field sites were used to examine the variability of nitrate-nitrogen concentrations in the unsaturated zone underneath the root zone. The specific data were nitrate-nitrogen concentrations in soil water in samples taken at 0.9-m intervals from the 4.5- to 11.9-m depth from four holes per site. Analyses of variance of these data provided estimates of variances that were used to predict the depth sampling interval and the number

of holes required for site means to be within confidence limits of 10, 20, and 30%. Calculations were based on sampling intervals of 0.9, 0.6, and 0.3 m providing 9, 13, and 26 samples per hole, respectively. Relationships developed between number of sites, number of holes required, sampling interval, and confidence limits were used to select sampling plans for degree of precision in comparison with the actual sampling procedure. A cost analysis of the field study indicated that it would cost three to four times more than the field study to use a sampling plan which would reasonably ensure that 75% of the sites' true means fall within 20% of the measured means at a confidence level of 95%. (Skogerboe-Colorado State)

W77-09974

CHANGES IN THE PHYSICAL PROPERTIES OF SOIL CLAYS DUE TO PRECIPITATED ALUMINUM AND IRON HYDROXIDES: II. COLLOIDAL INTERACTIONS IN THE ABSENCE OF DRYING.
Hawaii Univ., Honolulu. Dept. of Soil Science.
S. A. El-Swaifi.
Soil Science Society of America Journal, Vol 40, No 4, p 516-520, July-August 1976. 6 fig, 13 ref.

Descriptors: *Clays, *Flocculation, Soils, Soil properties, Soil investigations, Soil chemistry, *Soil chemical properties, *Alkalis(Bases), Iron compounds.
Identifiers: *Iron hydroxide, *Aluminum hydroxide.

Colloidal stability diagrams were constructed for suspensions of an illite, a kaolinite, and a mixture of the two into which $Al(OH)_3$ and $Fe(OH)_3$ were precipitated. These diagrams covered a pH range from 2.5 to 12.5 and electrolyte concentrations up to the flocculation value. It was revealed, in accordance with expected interactions of colloids with widely different isoelectric points, that the colloidal stability of each mixture was dependent on the charge balance between its individual constituents. Therefore, as long as a system has not encountered a drying cycle, hydroxides may provide favorable (flocculating) or non-favorable (colloidally stable) effects on soil structure depending on hydroxide type, its surface reactivity, and the clay mineral with which it may be associated. Generally, the two hydroxides provided equal enhancement of clay colloidal stability above their isoelectric points. However, $Al(OH)_3$ was more active in inducing clay flocculation and charge reversal at low pH values. (See also W77-03073) (Skogerboe-Colorado State)

W77-09975

MOVEMENT OF CARBARYL THROUGH CONGAREE SOIL INTO GROUND WATER.
Clemson Univ., S.C. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 5B.
W77-09976

UPTAKE OF CADMIUM BY SOYBEANS AS INFLUENCED BY SOIL CATION EXCHANGE CAPACITY, pH AND AVAILABLE PHOSPHORUS.
Argonne National Lab., Ill.
J. E. Miller, J. J. Hassett, and D. E. Koeppel.
Journal of Environmental Quality, Vol. 5, No. 2, p 157-160, April-June 1976. 1 fig, 5 tab, 21 ref.

Descriptors: *Cadmium, *Cation exchange, *Phosphorus, Greenhouses, Heavy metals, *Soybeans, *Absorption, *Plant growth, Crop response, Soil chemistry.
Identifiers: Heavy metal Pollution, Cadmium sorption.

The accumulation of cadmium and its effect on vegetative growth of soybeans in soils with a range in cation exchange capacity (CEC), pH and available

phosphorus (P) were investigated in greenhouse experiments. Cadmium uptake decreased as soil pH and CEC increased, while increasing available soil P was related to increased Cd accumulation. Cadmium extracted from the soil by Bray P1 reagent, Bray P2 reagent, 2N $MgCl_2$, and 0.1N EDTA was significantly correlated with plant Cd concentrations. The growth of the soybean shoots was generally depressed when tissue concentrations reached 3-5 micro g Cd/g dry weight. Cadmium uptake by soybeans was correlated with the ratio of added Cd to the Cd sorptive capacity of soil. (Skogerboe-Colorado State)

W77-09977

LONG-TERM EVALUATION OF SLOW-RELEASE NITROGEN SOURCES OF TURF-GRASS.
Community Coll. of the Finger Lakes, Canandaigua, New York.
For primary bibliographic entry see Field 3C.
W77-09978

SOLUBILITY AND SOLUBILITY PRODUCT OF DICALCIUM PHOSPHATE DIHYDRATE IN AQUEOUS SOLUTIONS AND SOIL SOLUTIONS.
Alabama Agricultural Experiment Station, Auburn. Dept. of Soils.
A. C. Bennett, and F. Adams.

Soil Science Society of America Journal, Vol. 40, No. 1, p 39-42, January-February 1976. 3 tab, 10 ref.

Descriptors: *Phosphates, Soils, Soil investigations, Soil properties, *Solubility, Aqueous solutions, Organic compounds, *Hydrates.
Identifiers: Phosphate fixation, Ionic activity, Ionic pairs, *Dicalcium phosphate, Dihydrate.

The solubility product ($Ca(2+)$ $(HPO_4(2-))$ of $CaHPO_4 \cdot 2H_2O$ was determined in several aqueous solutions containing ions common to soil solutions. Extrapolation of analytical Ca and P concentrations to zero ionic strength yielded $pK(sp)$ values ranging from 6.54 to 6.59 and averaging 6.57 for 10 aqueous salt solutions. A method of successive approximation that computed ionic activity was used to determine the $pK(sp)$ for three concentrations of 15 different aqueous salt solutions saturated with $CaHPO_4 \cdot 2H_2O$. Calculated $pK(sp)$ values ranged from 6.44 to 6.63; the average was 6.55. Eight soil samples that varied widely in pH and soil-test P were treated with $CaHPO_4 \cdot 2H_2O$ at rates of 600 to 3,000 ppm P. Soil solutions were displaced, analyzed, and $(Ca(2+))$ $(HPO_4(2-))$ was calculated. Eight of the 20 samples of soil were considered to be saturated with $CaHPO_4 \cdot 2H_2O$ because their $(Ca(2+))$ $(HPO_4(2-))$ values were approximately the same as that for similar aqueous salt solutions. It was concluded that the presence of excess $CaHPO_4 \cdot 2H_2O$ in soil could be inferred by ion-activity products of displaced soil solutions. (Skogerboe-Colorado State)

W77-09979

THE SLOW REACTION WHICH CONTINUES AFTER PHOSPHATE ADSORPTION: KINETICS AND EQUILIBRIUM IN SOME TROPICAL SOILS.
California Univ., Davis. Dept. of Soils and Plant Nutrition.
D. N. Munns, and R. L. Fox.

Soil Science Society of America Journal, Vol. 40, No. 1, p 46-51, January-February 1976. 7 fig, 2 tab, 18 ref.

Descriptors: *Phosphates, *Top soil, *Adsorption, Soils, Soil investigations, *Kinetics, Lime, Hysteresis, Soil properties, *Soil chemistry.
Identifiers: *Tropical soils, *Phosphate adsorption(Soils).

Dissolved phosphate was mixed with topsoil samples, and the decline in solution phosphate concen-

tration (P) was followed for 200-300 days by periodically shaking and extracting subsamples with 1 or 10 mM $CaCl_2$. During the first 20-40 days, (P) declined faster in soil suspensions that were being shaken than it did in undisturbed soil at 0.1 bar moisture. After 40 days of reaction, shaking time had little effect. The slow fixation had first-order kinetics with respect to (P). The relative rate was faster in an Andepto than in three Oxisols. It was unaffected by lime, though lime increased the strength of adsorption. Equilibrium was achieved at 50 days in an Andepto and 100-200 days in three Oxisols. At equilibrium, the amount of adsorbed phosphate remaining labile was estimated from values of (P), using 6-day adsorption isotherms. Labile phosphate so estimated amounted to 30-50% of the added phosphate, implying that the residual value of phosphate added to these soils should be substantial and permanent except for removal by crops and erosion. Desorption isotherms diverged from adsorption isotherms diverged from adsorption isotherms less markedly with increasing time after phosphate addition, as if the slow reaction caused much of the apparent hysteresis. (Skogerboe-Colorado State)

W77-09980

SCIENTIFIC BASES OF A SYSTEM FOR AVERTING UNFAVORABLE CONSEQUENCES OF STEPPE SOIL IRRIGATION. (IN RUSSIAN), Moscow State Univ. (USSR).

B. G. Rozanov.
Vestn Mosk Univ Ser 6 Biol Pochvoved. 29(3), p 19-25, 1974.

Descriptors: *Soil water, *Irrigation, Vegetation, Soil organisms, Geochemistry, Hydrogeology, Regulation, *Soil conservation.
Identifiers: USSR.

The solution of a problem of regulation of steppe soil water regime by the way of irrigation involves a number of side and secondary consequences unfavorable for future vegetation, soil organisms, hydrogeological and geochemical conditions. Measures for averting the unfavorable consequences of irrigation include engineering, meliorative and agrotechnical methods.—Copyright 1975, Biological Abstracts, Inc.
W77-10021

2H. Lakes

A GUIDE TO AERATION/CIRCULATION TECHNIQUES FOR LAKE MANAGEMENT.
Tetra Tech., Inc., Lafayette, Calif.
For primary bibliographic entry see Field 5G.
W77-09603

NUTRIENT DIVERSION: RESULTING LAKE TROPHIC STATE AND PHOSPHORUS DYNAMICS.
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W77-09604

STUDIES ON THE RECLAMATION OF STONE LAKE, MICHIGAN.
Notre Dame Univ., Ind.
For primary bibliographic entry see Field 5G.
W77-09605

WASTEWATER TREATMENT BY NATURAL AND ARTIFICIAL MARSHES.
Wisconsin Univ., Oshkosh.
For primary bibliographic entry see Field 5D.
W77-09606

Field 2—WATER CYCLE

Group 2H—Lakes

TEMPERATURE EFFECTS ON THE DENITRIFICATION PRODUCTS BY TWO AQUATIC PSEUDOMONAS SPECIES.
For primary bibliographic entry see Field 5C.
W77-09607

ECOLOGY OF THE AZOV VIMBA, VIMBA VIMBA CARINATA (PALL.), OF THE TSMILYANSK RESERVOIR, (IN RUSSIAN).
Gosudarstvennyi Nauchno-Issledovatel'skii Institut Ozerogo i Rechnogo Rybnogo Khozyaistva, Volgograd (USSR).
V. V. Yaremenko.
Vopr Ikhtiol. 14(4), p 693-696, 1974.

Descriptors: *Reservoirs, *Spawning, *Ecotypes, *Aquatic habitats, Ecology, Care, Population, Freshwater fish.
Identifiers: Abramis ballerus, Abramis brama, *Azov vimba, Blicca bjoerkna, Russian-SFSR, *Tsimlyansk Reservoir(USSR), *Vimba, Vimba vimba carinata, Carpbream, Zope, Silver bream, *USSR.

The vimba population of the Tsimlyansk Reservoir on the Don River (Russian SFSR, USSR) was formed from the Azov vimba Vimba vimba carinata and was caught in trawl catches for the 1st time in 1956. The process of adaptation and increase in abundance in the Tsimlyansk reservoir have proceeded more slowly than for the common carp, carpbream (Abramis brama), zope (A. ballerus), silver bream (Blicca bjoerkna) and other fishes. Two groups differing in spawning ecology have formed in the vimba population: a lithorheophilic group and a group reproducing in the presence of a weaker current. The 1st group is more abundant.—Copyright 1975, Biological Abstracts, Inc.
W77-09610

MACROPHYTE-SEDIMENT RELATIONSHIPS IN CHAUTAUGUA LAKE,
For primary bibliographic entry see Field 5C.
W77-09612

THE PHYSICO-CHEMICAL LIMNOLOGY OF THE MWENDA RIVER MOUTH, LAKE KARIBA,
Rhodesia Univ., Salisbury. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09614

THE CONSEQUENCES OF IMPOUNDMENT ON AN ARCTIC CHAR LAKE SYSTEM. AN ANALYSIS BY SIMULATION MODELLING.
For primary bibliographic entry see Field 5B.
W77-09616

AN INVESTIGATION OF THE ROLE OF ORGANIC MATERIALS IN FRESHWATER SYSTEMS.
For primary bibliographic entry see Field 5C.
W77-09618

MELOSIRA GRANULATA (EHR.) RALFS: MORPHOLOGY AND ECOLOGY OF A COSMOPOLITAN FRESHWATER DIATOM.
For primary bibliographic entry see Field 5C.
W77-09619

INTENSIVE LARGE CITY INFLUENCE ON REED-BANKS, (IN GERMAN),
Technische Universitaet, Berlin (West Germany). Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W77-09621

DIATOMS IN POND PLANKTON: RELATIONSHIPS TO EPIPHYTIC AND EPIPELIC POPULATIONS.
For primary bibliographic entry see Field 5C.
W77-09628

ANALYSIS OF THE POPULATION DYNAMICS OF OSCILLATORIA REDEKEI VAN GOOR IN LAKE EDEBERG,
For primary bibliographic entry see Field 5C.
W77-09629

A FOOD WEB MODEL FOR LAKE MICHIGAN: PART I—JUSTIFICATION AND DEVELOPMENT OF THE MODEL.
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W77-09631

PLANKTON ECOLOGY IN LONG POND, ST. JOHNS, NEWFOUNDLAND: A POLLUTED POND CHARACTERIZED BY A HIGH FLUSHING RATE.
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-09664

MERCURY ACCUMULATION BY LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN RECENTLY IMPOUNDED RESERVOIRS.
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 5C.
W77-09667

THE EFFECT OF WIND ON THE DISTRIBUTION OF CHLOROPHYLL A AND CRUSTACEAN PLANKTON IN A SHALLOW EUTROPHIC RESERVOIR.
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W77-09679

SHORT TERM SEDIMENTATION RESPONSE IN LAKES IN WESTERN UNITED STATES AS MEASURED BY AUTOMATED SAMPLING.
New Mexico Univ., Albuquerque. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W77-09701

DOMESTIC AND AGRICULTURAL CONTRIBUTIONS TO THE INPUTS OF PHOSPHORUS AND NITROGEN TO LOUGH NEAGH,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5B.
W77-09722

DILUTION CHARACTERISTICS OF EFFLUENTS IN DEEP WATER RESERVOIRS DETERMINED WITH A RADIOACTIVE INDICATOR (ON THE EXAMPLE OF LAKE BAIKAL), (IN RUSSIAN).
For primary bibliographic entry see Field 5B.
W77-09735

LEAD AND FRESHWATER FISHES: PART 2—IONIC LEAD ACCUMULATION.
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
For primary bibliographic entry see Field 5C.
W77-09779

CALCIUM CARBONATE FORMATION BY ENTEROMORPHA NANA ALGAE IN A HYPER-SALINE VOLCANIC CRATER LAKE.
Australian National Univ., Canberra. Dept. of Biogeography and Geomorphology.
J. Dodson.
Hydrobiologia. Vol. 44, No. 2/3, p 247-255, 1974.

Descriptors: Marl, Basalts, *Algae, Australia, *Calcium carbonate, Craters.
Identifiers: Aragonite, Enteromorpha-nana.

On the black basaltic rock surfaces in shallow water around the margin of Lake Gnotuk (Australia), and for several meters above the present lake, there is a thick white coating of aragonite marl. The water in the lake is supersaturated with CaCO₃. From close observation and experimental work, it is evident that the marl is produced by the alga E. nana which lives in the shallow lake water and grows attached to the basalt. The general mechanism of CaCO₃ precipitation by aquatic plants is outlined, and in E. nana, it can be demonstrated that the closed tubular thallus absorbs HCO₃⁻ from the outside water and secretes CO₂-3 inside the tube. This secretion of CO₂-3 greatly increases the ionic product of (CA₂+)(CO₂-3) in the water inside the thallus, and leads to the precipitation of aragonite and its accumulation at the base of the tube.—Copyright 1974, Biological Abstracts, Inc.
W77-09787

A REPORT ON STUDIES OF THE EFFECTS OF DREDGING AND DISPOSAL IN THE GREAT LAKES WITH EMPHASIS ON CANADIAN WATERS.
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W77-09794

FILTERING RATE INHIBITION OF DAPHNIA PULEX IN WINTERGREEN LAKE WATER.
Michigan State Univ., East Lansing. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09910

THE SHORE AND THE WATER-THE LOCALIZATION OF DAMAGE AND THE REGULATION OF FISH MANAGEMENT IN CONTROLLED LAKES, (IN SWEDISH).
For primary bibliographic entry see Field 4A.
W77-09935

URCEOLARIDS (CILIATA, PERITRICHIA) FROM FISHES OF THE URALS, (IN RUSSIAN).
Siberian Research Inst. of the Fish Industry, Sverdlovsk (USSR). Ural Div.
V. V. Kashkovskii.
Parazitologiya (Leningr). 8(4), p 368-378, 1974.

Descriptors: *Fish parasites, *Protozoa, Lakes, Ponds.
Identifiers: *Peritricha, Trichodina carassii, Trichodina domerguei acuta, Trichodina domerguei esocis, Trichodina meridionalis, Trichodina mira, Trichodina mutabilis, Trichodina nigra, Trichodina nigra gobii, Trichodina nigra nemachili, Trichodina nobilis, Trichodina pediculus, Trichodina pollicirra, Trichodina reticulata, Trichodina rostrata, Trichodina spatulata, Trichodina urinaria, Trichodinella, Trichodinella epizootica, Trichodinella epizootica lotae, Trichodinella percarum, Tripartitella bulbosa, Tripartitella copiosa, Tripartitella incisa, Urals, *Urceolariids, *USSR.

Parasitological investigations were carried out in 15 lakes and 7 ponds of the Sverdlovsk and Cheljabinsk regions of USSR in 1966-1972. Fishes (5008 specimens of 17 spp.) of different ages were examined. In them were 23 spp. and forms of ur-

ceolariids (Tripartiella bulbosa, T. copiosa, T. incisa, Trichodina domerguei f. esocis, T. domerguei f. acuta, T. meridionalis, T. mira, T. mutabilis, T. nobilis, T. nigra, T. nigra f. gobii, T. nigra f. nemachili, T. pediculus, T. policirra, T. reticulata, T. rostrata, T. spathulata, T. urinaria, Trichodina carassii, Trichodina, T. epizootica, T. percarum, T. epizootica f. lotae). Microphotographs, biometrical indices of Infusoria and degrees of infestation in waters of different types are given. Copyright 1975, Biological Abstracts, Inc. W77-09936

CHARACTERISTICS OF THE ZOOPLANKTON OF THE LOWER REACHES OF THE IRGIZ AND TURGAY RIVERS, (IN RUSSIAN), Kazakh Research Inst. of Fisheries, Balkhash (USSR). For primary bibliographic entry see Field 5C. W77-09940

WATER SUPPLY FROM SHELBYVILLE AND CARLYLE LAKES AND THEIR OPTIMAL JOINT OPERATION, Illinois State Water Survey, Urbana. Hydrology Section. For primary bibliographic entry see Field 4A. W77-09943

SEASONAL VARIATIONS IN GREAT LAKES DESIGN WAVE HEIGHTS: LAKE ERIE, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-09986

DICKEY-LINCOLN SCHOOL LAKES HYDROTHERMAL MODEL STUDY; HYDRAULIC LABORATORY INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-09987

LAKE DARDANELLE, ARKANSAS RIVER; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-09988

DESIGN FOR SMALL-BOAT HARBOR IMPROVEMENTS, PORT WASHINGTON HARBOR, WISCONSIN; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-09989

IGLOO WAVE ABSORBER TESTS FOR PORT WASHINGTON HARBOR, WISCONSIN; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-09990

THE GREAT DISMAL SWAMP: MANAGEMENT OF A HYDROLOGIC RESOURCE WITH THE AID OF REMOTE SENSING, Geological Survey, Reston, Va. Water Resources Div.; and Great Dismal Swamp National Wildlife Refuge, Suffolk, Va.; and National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. V. Carter, M. K. Garrett, L. Shima, and P. Gammon. Water Resources Bulletin, Vol 13, No 1, p 1-12, February 1977. 4 fig. 6 ref.

Descriptors: *Swamps, Hydrology, *Remote sensing, *Mapping, *Aerial photography, Satellites(Artificial), Wetlands, Marshes, Lakes, Vegetation, Photogrammetry. Identifiers: *Great Dismal Swamp(NC and VA).

The Great Dismal Swamp is a forested wetland located on the Virginia-North Carolina border on the southern Atlantic coastal plain. It covers 84,000 hectares and is developed on organic soils ranging in depth from 4 meters in ancient drainage channels to less than 0.3 meters along the outer edges. Lake Drummond, approximately 4.0 kilometers in diameter, is almost centrally located within the gently east sloping gradient of the swamp. The origin and present hydrologic regime of the swamp and Lake Drummond are still in dispute because of the complex regional geology and fragmented historical record. Both color infrared aerial photography and Landsat data are providing information to meet present and future management goals for the Great Dismal Swamp National Wildlife Refuge. High and low altitude color infrared photographs are being used to study the hydrology and map the present vegetation of the swamp. A variety of significant ecologic units have been identified with the photographs. The completed maps will be used to evaluate analyses of Landsat digital data. Once the present data base is compiled, it is hoped that routine analysis of Landsat data can be used for updating or to indicate areas where low altitude coverage or ground checking is desirable. The data base also will aid in identifying and evaluating trends that may provide guidelines for wetland management. (Woodard-USGS) W77-10007

PLANKTONIC CILIATES IN THE IVAN'KOVO WATER RESERVOIR, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod. For primary bibliographic entry see Field 5C. W77-10010

STUDIES ON THE BOTTOM FAUNA OF FOUR LAKES IN EASTERN HIKKAIDO (LAKES KUSHIYARO-KO, AKAN-KO, TORO-KO AND SHIKARIBETSU KO, (IN JAPANESE), Mieken Science Education Center, Yokkaichi (Japan). For primary bibliographic entry see Field 5C. W77-10028

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 17-4, NUMERICAL MODEL FEASIBILITY STUDY, Army Engineer Waterway Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 8B. W77-10048

BOTTOM WITHDRAWAL CAN ENHANCE LAKE WATER QUALITY, Arkansas Univ., Fayetteville. Dept. of Civil Engineering. For primary bibliographic entry see Field 5G. W77-10049

ALGAL NUTRIENT AVAILABILITY AND LIMITATION IN LAKE ONTARIO DURING IFGYL PART 1, AVAILABLE PHOSPHORUS IN URBAN RUNOFF AND LAKE ONTARIO TRIBUTARY WATERS, Texas Univ. at Dallas, Richardson. Center for Environmental Studies. For primary bibliographic entry see Field 5C. W77-10052

AN INVESTIGATION OF THE NEARSHORE REGION OF LAKE ONTARIO IFGYL, State Univ. of New York Coll. at Buffalo. Great Lakes Lab. For primary bibliographic entry see Field 5C. W77-10053

RESTORATION OF LOWER ST. REGIS LAKE (FRANKLIN COUNTY, NEW YORK), New York State Dept. of Health, Albany. Environmental Health Center. For primary bibliographic entry see Field 5C. W77-10054

BAY SPRINGS LAKE WATER-QUALITY STUDY, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab. For primary bibliographic entry see Field 5B. W77-10055

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION: VOL. 4. PHYTOPLANKTON OF LAKE MICHIGAN, National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab. For primary bibliographic entry see Field 5C. W77-10056

BIOLOGICAL, CHEMICAL AND PHYSICAL RELATIONSHIPS IN THE STRAITS OF MACKINAC, Michigan Univ., Ann Arbor. Great Lakes Research Div. For primary bibliographic entry see Field 5C. W77-10058

UNDERWATER HABITATS FOR SCIENTIFIC RESEARCH IN THE GREAT LAKES, Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography. For primary bibliographic entry see Field 7B. W77-10060

BIOLOGICAL EFFECTS AND PERSISTENCE OF METHYL PARATHION IN CLEAR LAKE, CALIFORNIA, Lake County Mosquito Abatement District, Lakeport, Calif. For primary bibliographic entry see Field 5C. W77-10063

THE ECOLOGY OF CHYDORIDAE (CLADOCERA) OF LAKE BAIKAL (IN RUSSIAN), Irkutskii Gosudarstvennyi Universitet (USSR). Lake Baikal Biological Station. G. L. Vasil'eva, and N. N. Smirnov. Zool Zh 54(9), p 1293-1305, 1975.

Descriptors: *Ecology, *Lakes, *Crustaceans, *Distribution patterns, Benthos, Littoral, Population, Cellulose, Biomass. Identifiers: Alona labrosa, Alona rectangula, Alona setosocaudata, Baikal, *Chydoridae, Chydorus piger, Chydorus sphaericus, Kozhovia baicalensis, Kozhovia gajewskajae, Kozhovia kozhovi, Kozhovia primigenia, Pollution zone, USSR, Population structure, Population density.

The distribution of Chydoridae in Lake Baikal (USSR) was studied. Males of 4 spp. of the genus Kozhovia were found. The endemic Chydoridae form a complex characteristic of the mesobenthos of open and slightly protected littoral regions. The annual dynamics of population structure and density was studied for K. baicalensis, Alona labrosa and A. setosocaudata. They live and propagate in the pollution zone of the Baikal cellulose plant. The population density of Chydoridae in Lake

Field 2—WATER CYCLE

Group 2H—Lakes

Baikal attains 10-15,000/m² and that of *Chydorus sphaericus* 80,000. The biomass of Chydoridae makes, on the average, 0.5-10% of the whole mesobenthos biomass and up to 50% at some stations. (A. *rectangula*, C. *piger*, K. *Primigenia*, K. *gajewskajae* and K. *kozhowi* are also mentioned.) W77-10064

THE DARWENDALE RESERVOIR AS A FISHERY.

Rhodes Univ. (Salisbury). Dept. of Zoology. A. P. Bowmaker.
The Rhodesia Science News, Vol. 10, No. 6, p 152-156, June 1976, map, fig, 3 ref.

Descriptors: Reservoirs, Fisheries, Nutrients, Water temperature, Water level fluctuations, Commercial fishing, Spawning, Fish migration, *Fish management, Africa.
Identifiers: Tilapia *randalli*, *Sarotherodon macrochir*, *Hydrocynus vittatus*, *Labeo altivelis*, *Clarias gariepinus*, Darwendale Dam, Lake McIlwaine, Huyani River, *Rhodesia, Southern Africa.

Rhodesia ideally situated to produce fish at a high return per unit area. The present nutrient status of the Hunyani river system and the tropical situation create ideal conditions for the production of a high yield of fish in the Lake McIlwaine/Darwendale reservoir system. This paper aims to clarify the role of fish production as one facet of a multi-purpose utilisation, and to suggest guidelines for the proper management of the system from a food production viewpoint. Possible production levels are estimated. (So. African Water Info. Center) W77-10096

WATERFOWL (ANATIDAE) ON IRRIGATION LAKES IN THE ORANGE FREE STATE.

Orange Free State Univ., Bloemfontein (South Africa). Dept. of Nature Conservation. J. N. Geldenhuys.
The Ostrich, Vol. 46, No. 3/4, p 219-235, 1975. 9 tab, map, 6 fig, 13 ref.

Descriptors: Bioindicators, Water birds, Irrigation, Lakes, Dams, Breeding, Seasonal, Populations, Migration patterns, Food chains, Africa, Farm ponds, Impoundment, Africa.
Identifiers: Erfenis Dam, Koppies Dam, Bloemhof Dam, Allemanskraal Dam, Krugersdrift Dam, Tierspoort Dam, Rustfontein Dam, Kalkfontein Dam, *Orange Free State, South Africa.

The influence of large man-made impoundment on the total permanent water area and shoreline length in South Africa has been described previously. The future of South African waterfowl will be determined largely by their ability to exploit the new artificial environments. The emphasizes a need for data on the distribution and population strength of waterfowl utilizing these habitats. There are no systematic counts of water fowl on irrigation lakes in the Orange Free State, though a relatively high number of these waters exist in the province. In other parts of the country censuses have been conducted, but these usually were restricted to one particular locality at a time. The aim of the present study was to investigate the incidence and population size of fifteen duck species on none irrigation lakes in the Orange Free State from August 1972 to July 1973. The most common species were the Egyptian Goose, South African Shelduck, Yellowbilled duck, and Spurwinged duck, in that order. Relatively high seasonal fluctuations were found in populations of the South African Shelduck, Cape Teal, Southern Pochard, and to a lesser extent in the Spurwinged goose and Cape Shoveller. (So. African Water Info. Center) W77-10097

LAKE SIBAYA - A LAND-LOCKED ESTUARY, Rhodes Univ., Grahamstown (South Africa) Inst. of Freshwater Studies. M. N. Bruton.

Scientiae, Vol. 16, No. 6, p 19-28, 1975. 14 fig, 54 ref.

Descriptors: Estuaries, Bioindicators, *Environmental effects, Ecology, Limnology, *Lakes, Benthic fauna, Zooplankton, Seasonal, Food chains, Fish hatcheries, Feeding habits, Diatoms, Primary productivity, Africa.
Identifiers: *Lake Sibaya, Kwazulu, Tongaland, Natal, South Africa.

Lake Sibaya was apparently once an estuary and there are many creatures living in it that are normally only found in salt waters. Research is being conducted on how these estuarine organisms have adapted to the foreign environment of a freshwater lake. With the increasing commercial development of hitherto unexploited areas of South Africa, Lake Sibaya and its environs are among the few remaining regions as yet virtually undisturbed by man, and offers a rare opportunity to study an ecosystem in its pristine state. Research is providing the scientific data necessary for the rational exploitation of the natural resources of the lake, and in a wider context, making available information that should be of inestimable value for the management of natural lakes, man-made dams and other water systems throughout South Africa. A summary is made of research projects and results. A bibliography on Lake Sibaya is included (So. African Water Info. Center) W77-10099

21. Water In Plants

CONCERNING THE INFLUENCE OF THE HYDROGEN ION CONCENTRATION AND OF THE BICARBONATE CONCENTRATION ON THE STRUCTURE OF BIOGENOSES OF MOUNTAIN BROOKS, (IN GERMAN), H. Ziemann.

Int Rev Gesamten Hydrobiol 60(4), p 523-555, 1975.

Descriptors: *Hydrogen ion concentration, *Bicarbonates, Streams, *Diatoms, *Aquatic insects, *Mayflies, Water temperature, Trophic level, *Stoneflies, Water chemistry.
Identifiers: Biocenoses, *Trichoptera.

The diatom flora and the Plecoptera, Ephemeroptera and Trichoptera fauna were investigated in 2 mountain brooks in the Thuringer Woods (East Germany), which had different chemistries. The different effects on the biocenoses of the regional factors of water chemistry, and of extra-regional factors, current and temperature are discussed. The zoocenotic division of mountain streams is affected by extra-regional factors; the structure of the diatom associations and the distribution of individual species of the insect fauna are dependent on the regional effect of the water chemistry. The correlation of halobitic indices as ecological characteristics of the diatom flora with the factors of water chemistry, the pH and alkalinity, and their relationship with the distribution of some insect species suggest that the halobitic index is a useful criterion for the ecological classification of waters. For the judgement of trophic conditions and the self-purification of waters, the halobitic index can be regarded as an additional criterion. W77-09620

ECOLOGICAL AND TOPOGRAPHIC SERIES OF VEGETATION OF EROSION FORMS OF RELIEF IN THE NORTHEAST OF THE CHERNIGOV TERRITORY, (IN UKRAINIAN), Akademiya Nauk USSR, Kiev. Instytut Botaniki. A. I. Kuz' Mychov, and I. S. Antonov.

Ukr Bot Zh 32(2), p 217-219, 1975.

Descriptors: *Ecology, *Topography, *Vegetation, Erosion, *Forest management.

Identifiers: *USSR(Northeast Chernigov Territory).

Fragments of primary forest vegetation derivative forest aggregations and herbaceous vegetation on unforested slopes are described for the region under study (USSR). Peculiarities in distribution of different associations of the forest and herbaceous vegetation are dependent on exposition of slopes and their steepness. These associations are discussed and a short description of the plant cover composition is presented for most of them. W77-09622

A PRACTICAL APPARATUS FOR QUANTITATIVE SAMPLING OF PERIPHYTON, (IN FRENCH), Liege Univ. (Belgium). Dept. of Botany.

For primary bibliographic entry see Field 7B. W77-09623

THE EFFECTS OF GRANITIC SAND ON THE DISTRIBUTION AND ABUNDANCE OF SALMONIDS IN IDAHO STREAMS, Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.

L. C. Stuehnenberg.

Descriptors: Sediments, Trout, Salmon, Benthos, Sediment transport, Insect drift, Fish food organisms, Streams, *Idaho, Aquatic insects, *Sands, *Distribution, *Salmonids, Biota.
Identifiers: *Central Idaho Batholith, *Chinook salmon, *Steelhead trout, Bedload sediment.

In the summers of 1972 and 1973 an interdisciplinary team studied the effects of different levels of Central Idaho Batholith on the aquatic biota in streams. The work was conducted in artificial stream channels at the Hayden Creek Experimental Research Station and in streams in the Central Idaho Batholith. The fisheries part of the study assessed: (1) the effects of sediment in summer habitat on juvenile steelhead trout (*Salmo gairdneri*) and chinook salmon (*Oncorhynchus tshawytscha*), and (2) the effect of sediment in winter habitat on juvenile steelhead trout and chinook salmon. Juvenile steelhead trout and chinook salmon were not affected by the levels of batholith sediment added to riffle sections during summer but a reduction of pool area by sediment caused a direct decrease in the number of fish present in the pools. Under winter stream conditions age-0 steelhead trout and chinook salmon did not remain in riffle sections when sediment filled the interstitial spaces of the gravel substrate. W77-09797

THE ORIGIN AND STRUCTURE OF AMERICAN ARID-ZONE ECOSYSTEMS. THE PRODUCERS: INTERACTIONS BETWEEN ENVIRONMENT, FORM AND FUNCTION, San Diego Univ., Calif. Dept. of Biology.

For primary bibliographic entry see Field 2A. W77-09933

COMPARATIVE STUDY OF THE ANTIFUNGAL ACTIVITY OF TRITERPENE GLYCOSIDES OF PACIFIC HOLOTHURIANS, (IN RUSSIAN), Akademiya Nauk SSSR, Vladivostok. Institut Biologii.

M. M. Anisimov, V. V. Shcheglov, V. A. Stonik, A. L. Kul'ga, and E. V. Levina.
Dokl Akad Nauk SSSR Ser Biol. 107(3), p 711-713, 1972.

Descriptors: Fungicides.
Identifiers: *Glycosides(Triterpene), *Holothurians(Pacific), Antifungal activity.

The antifungal activity of several holothurian triterpene glycosides was shown.—Copyright 1975, Biological Abstracts, Inc. W77-09938

SIMULATION OF PLANT GROWTH BY HUMIC SUBSTANCES

Vermont Univ., Burlington. Dept. of Plant and Soil Science.
Y. S. Lee, and R. J. Bartlett.
Soil Science Society of America Journal, Vol 40, No 6, p 876-879, November-December 1976. 1 fig, 6 tab, 15 ref.

Descriptors: *Organic matter, Corn(Field), *Plant growth, Algae, Nutrients, Phosphorus, Iron, *Growth rates, Crop response, *Humus, Decomposing organic matter, Simulation analysis.

Humic substances prepared by different techniques of extraction and from different sources of organic materials were tested for their effects on growth of corn seedlings and algae. Stimulating effects were confirmed with optimum concentrations about 5 ppm C as Na-humate for corn and 60 ppm for algae. With corn, the increase was 30 to 50% in nutrient solution or low organic matter soil; with algae, about 100%. Variation of effects among humic acids derived from different organic materials was not great. The concentrations of elements in corn seedlings did not show any correlation with yield or humic acid level except for P and Fe. Phosphorus concentration was increased with increasing levels of humic acid regardless of the yield response. Higher Fe concentration in the plant tops and lower in roots was observed in the treatments with humic acid. The application of humic acid to a soil low in organic matter or to nutrient solution gave the greatest growth response. Application to a high organic matter soil gave little growth response, or even a slightly negative response, indicating that the natural soil, without extraction, supplied optimum amount of humic substances to the plants. It is suggested that a test be developed to predict whether a given soil can furnish an optimum level of humic substances. (Skogerboe-Colorado State) W77-09963

NITROGEN, PHOSPHORUS, AND POTASSIUM UTILIZATION IN THE PLANT-SOIL SYSTEM: AN ANALYTICAL MODEL

Oak Ridge National Lab., Tenn.
O. L. Smith.
Soil Science Society of America Journal, Vol 40, No 5, p 704-714, September-October 1976. 11 fig, 2 tab, 61 ref.

Descriptors: *Nitrogen, *Phosphorus, *Potassium, Model studies, Crop production, Crop response, Absorption, Nutrients, Simulation analysis.

An intermediate-resolution analytical model of nitrogen, phosphorus, and potassium utilization in the plant-soil system was developed and tested. Starting from specified natural or artificial sources in the soil, element transport to root absorption surfaces was modeled in terms of diffusion, mass flow, and soil buffering mechanisms. Element uptake was described by carrier theory formalism, and assimilation was based on four premises about the roles of N, P, K, and photosynthate in cell chemistry. There were three main objectives of the model. The first was to predict the first-order interactive growth response of particular plant species to any combination of these macronutrients supplied in the soil medium. Species parameters required by the model include root absorption rate and certain cell chemistry reaction rates. The second objective was to make the model sufficiently general to describe a broad range of species. It was built upon common denominator principles of physiology condensed from available experimental data on corn, bean, pine, etc. In this generic sense it is a measure of what plants have in common. The third objective was to use the model to test several well-known theories of plant growth. The model was validated against reported experiments on ryegrass, oat, a legume, and rutabaga, in which dry matter yield was measured as a function of factorial application of N, P, and K

to the soil. The model shows that much of the deficient, optimal, toxic, and interactive response of plants to N, P, and K can be explained in terms of strong linear response of cell chemistry to low nutrient concentrations and inhibition by N, P, and K at high nutrient concentrations. (Skogerboe-Colorado State) W77-09964

METHOD OF ANALYZING SOME EXPERIMENTAL DATA ON ZOOPLANKTON, (IN RUSSIAN)

Biologo-Geograficheskii Nauchno-Issledovatel'skii Institut, Irkutsk (USSR).
E. N. Ladeishchikova, and G. L. Vasil'Eva.
Gidrobiol Zh 12(3), p 97-103, 1976.

Descriptors: *Zooplankton, Reproduction, Life cycles, Computer models, *Mathematical models, *Data storage and retrieval, Data collections.
Identifiers: *Notholca grandis.

Experimental data on the life cycle, particularly aspects of reproduction, in *Notholca grandis* females were systematized through unification in a multidimensional matrix and subsequent representation in tables and graphs. Results of the analysis of these and similar data using the described method may be applied in the calculation of the general biological characteristics of populations and water bodies. The method provides a convenient form for the generalization, storage and preparation of data for computer analysis and the construction of mathematical models.—Copyright 1977, Biological Abstracts, Inc. W77-10038

STABILIZATION OF SAND DUNES IN THE WEST SAHARA

Department of Forestry, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W77-10074

2J. Erosion and Sedimentation**STUDIES ON THE RECLAMATION OF STONE LAKE, MICHIGAN**

Notre Dame Univ., Ind.
For primary bibliographic entry see Field 5G.
W77-09605

THE ROLE OF HUMIC ACIDS IN THE UPTAKE AND RELEASE OF MERCURY BY FRESHWATER SEDIMENTS

For primary bibliographic entry see Field 5B.
W77-09615

AN INVESTIGATION OF THE ROLE OF ORGANIC MATERIALS IN FRESHWATER SYSTEMS

For primary bibliographic entry see Field 5C.
W77-09618

COMPETITION FOR MERCURY BETWEEN RIVER SEDIMENT AND BACTERIA

Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W77-09661

NITROGEN FIXATION IN ARCTIC MARINE SEDIMENTS: EFFECT OF OIL AND HYDROCARBON FRACTIONS

Macdonald Coll., Ste. Anne de Bellevue (Quebec).
Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W77-09676

SHALLOW MARINE SAND BAR SEQUENCES: AN EXAMPLE FROM THE LATE PRECAMBRIAN OF NORTH NORWAY

Oxford Univ. (England). Dept. of Geology and Mineralogy.
H. D. Johnson.
Sedimentology, Vol. 24, No. 2, p 245-270, April 1977. 15 fig, 1 tab, 67 ref.

Descriptors: *Sandstones, *Sand bars, Europe, *Sedimentation, Sedimentary structures, Geology, Foreign countries, Foreign research, Offshore platforms, Sedimentology.
Identifiers: *Norway, *Shallow marine sand bars, Subtidal sand bars, Late Precambrian.

Five coarsening upward shallow marine sandstone sequences (2-10 m thick), were described from the late Precambrian of North Norway, where they occur in a laterally continuous and tectonically undeformed outcrop. The sequences consist of five facies with distinct assemblages of sedimentary structures and palaeocurrent patterns. Each facies is the product of alternate phases of sedimentation during relatively high- and low-energy periods. Facies 1 to 4 were interpreted as representing prograding, subtidal sand bars. Sand bar progradation occurred during the highest energy periods when unidirectional currents flowed to the northwest, depositing trough cross-bedded sandstones (facies 3 and 4) on the bar crests and flanks, and sheet sandstone beds (facies 1 and 2) in the offshore environments. Weaker northwesterly flowing currents continued during moderate energy fair weather periods. Low energy fair weather periods were dominated by wave processes, which formed large-scale, low-angle, westerly inclined surfaces on the bar blanks (facies 4) and wave rippled sandstone beds (facies 2) and flat laminated siltstone layers (facies 1) in the offshore environments. One sand bar was dissected by channels and infilled by tabular cross-bedded sandstones (facies 5). Bipolar palaeocurrent evidence, with two modes separated into two laterally equivalent channel systems, suggests deposition by tidal currents in mutually evasive ebb and flood channels. The inferred processes of the sand bars were compared with those associated with modern storm-generated and tidal current-generated linear sand ridges. Both kinds of ridges are influenced by the interaction of relatively low and high energy conditions. The presence of the tidal channel facies, however, combined with the inferred strong bottom current regime, is more analogous to a tidal current hydraulic regime. (Lee-ISWS) W77-09699

DEEP DISTRIBUTARY CHANNELS AND GIANT BEDFORMS IN THE UPPER CARBONIFEROUS OF THE CENTRAL PENNINES, NORTHERN ENGLAND

Keele Univ. (England). Dept. of Geology.
P. J. McCabe.
Sedimentology, Vol 24, No 2, p 271-290, April 1977. 12 fig, 45 ref.

Descriptors: *Channel erosion, Europe, *Sediment sorting, Deltas, Dunes, Channels, *Sedimentation, Geology, Watersheds(Basins), Foreign countries, Foreign research, *Sedimentology.
Identifiers: *Deep distributary channels, *England(Upper Carboniferous), Giant bedforms, Delta slope deposits.

Channels, with maximum depths of over 40 m, have been cut into the top of a coarsening upward sequence in the Upper Carboniferous of northern England. The channels are interpreted as deep, distributaries cut into delta slope deposits. Giant cross-bed sets, up to 40 m thick, are the major channel infilling facies. Internal erosion surfaces occur within the giant cross-beds, and some are draped by micaceous, silty sandstone. Previously interpreted as deltaic sedimentation units, the cross-beds now are thought to have been produced mainly by side attached, alternate bars, and the

Field 2—WATER CYCLE

Group 2J—Erosion and Sedimentation

drapes are interpreted as low stage deposits. Cosets of medium scale cross-beds overlie the giant cross-beds. The cosets are thought to be deposits of dunes and smaller bars on top of the transverse bars and in the shallower parts of the distributary. The giant cross-beds commonly are underlain by unlaminated sandstone, but the cross-beds may be underlain by undulatory bedding. The latter apparently was produced by ridges, parallel to the current, spaced between 9 and 23 m apart. The north of England appears to have had a major river by present day standards, for at least part of the upper Carboniferous. (Lee-ISWS)
W77-09700

SHORT TERM SEDIMENTATION RESPONSE IN LAKES IN WESTERN UNITED STATES AS MEASURED BY AUTOMATED SAMPLING. New Mexico Univ., Albuquerque. Dept. of Geology. R. Y. Anderson.
Limnology and Oceanography, Vol 22, No 3, p 423-433, May 1977. 10 fig, 12 ref. NSF GA13573, DES74-17499, EAR74-17499 A01.

Descriptors: *Sedimentation, *Utah, *New Mexico, *Nevada, *Lake sediments, *Sedimentation rates, Lakes, Sampling, Equipment, Instrumentation, Sediments, Sediment transport, Sediment discharge, Storms, Precipitation (Atmospheric), Diurnal distribution, On-site investigation, Limnology, Sedimentology.
Identifiers: *El Vado Lake(NM), *Morgan Lake(NM), *Lake Powell(Utah), *Pyramid Lake(Nev).

Sediment traps that can greatly amplify the rate of sedimentation and automatically time the depositional process were set out in El Vado Lake and Morgan Lake (New Mexico), Lake Powell (Utah), and Pyramid Lake (Nevada). In El Vado and Morgan lakes, sediment fluctuations on the scale of days were responsive to local weather factors, with the deposition rate in Morgan Lake greater near the bottom of the water column than near the top. Sedimentation in El Vado and Pyramid lakes appeared to have some diurnal control. Sedimentation in Pyramid Lake and Lake Powell, the two lakes fed by large rivers, was strongly influenced by river discharge and showed lag effects proportional to the distance of sediment transport. (Sims-ISWS)
W77-09701

BASAL TILL FABRICS OF MODERN ALPINE GLACIERS. Washington Univ., Seattle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2C.
W77-09704

SEDIMENT TRANSPORT AND DEPOSITION AT RIVER MOUTHS: A SYNTHESIS. Sydney Univ. (Australia). Dept. of Geography. L. D. Wright.
Geological Society of American Bulletin, Vol 88, No 6, p 857-868, June 1977. 8 fig, 2 tab, 66 ref.

Descriptors: *Sediment transport, *Rivers, *Sediment discharge, *Sediment, Sediment load, Turbulent flow, Geology, Hydraulics, Sediment distribution, Tidal effects.
Identifiers: *River mouths, *Sediment deposition, Outflow inertia, Turbulent bed friction, Outflow buoyancy.

River-mouth process studies and comparisons of river-mouth forms from contrasting environments suggested that sediment dispersal and accumulation patterns are governed by three basic effluent forces and by tide- or wave-induced processes. Neglecting modifications by tides or waves, effluent behavior, and consequent depositional patterns depend on the relative dominance of (1) out-

flow inertia, (2) turbulent bed friction seaward of the mouth, and (3) outflow buoyancy. Inertia-dominated effluents are characterized by fully turbulent jet diffusion, exhibit low lateral spreading angles and progressive lateral and longitudinal deceleration, and produce narrow-mouth bars. Under most natural circumstances, inertial effects are equaled or exceeded by either turbulent bed friction or effluent buoyancy. Shallow depths immediately basinward of a river mouth enhance the effects of bed friction, causing more rapid deceleration and lateral expansion. Triangular 'middle-ground' bars and frequent channel bifurcation result. Low tidal ranges, fine-grained sediment loads, and deep outlets favor strong density stratification within the lower reaches of the channels. Under such circumstances, effluents are dominated by the effects of buoyancy for at least part of the year. Buoyant effluents produce narrow distributary mouth bars, elongate distributaries with parallel banks, and few bifurcations. In macrotidal environments where tidal currents are stronger than river flow, bidirectional currents redistribute river sediments, producing sand-filled, funnel-shaped distributaries and causing linear tidal ridges to replace the distributary mouth bar. Powerful waves promote rapid effluent diffusion and deceleration and produce constricted or deflected river mouths. (Lee-ISWS)
W77-09705

NORTH ATLANTIC ICE-RAFTING: A MAJOR CHANGE AT 75,000 YEARS BEFORE THE PRESENT. Lamont-Doherty Geological Observatory, Palisades, N.Y. W. F. Ruddiman.
Science, Vol 196, No 4295, p 1208-1211, June 10, 1977. 2 fig, 17 ref. NSF GA 14177, GA 10635, GA 19690, ONR N00014-67A-0108-0004.

Descriptors: *Sediments, *Oceans, *Glaciers, *Atlantic Ocean, Ice, Melting, Circulation, Water circulation, Ocean circulation, Cores, Sampling, Sedimentation, Sedimentation rates, Geomorphology, Geology, Glaciology.
Identifiers: *Ice-rafting, *North Atlantic Ocean.

During the last interglacial-to-glacial climatic cycle (127,000 to 10,000 years before the present (B.P.)), the fundamental geographic shift in the main axis of ice-rafting deposition occurred at 75,000 years B.P. An earlier meridional depositional maximum along the Greenland-Newfoundland coasts was superseded by a nearly zonal and much stronger axis some 1500 kilometers to the south along 40 deg N to 50 deg N. Both depositional patterns are best explained by cyclonic flow in the subpolar gyre, with the depositional shift related to the retreat of warm, ice-melting North Atlantic drift water from the northwestern half of the gyre. Similar shifts must have characterized preceding interglacial-glacial cycles. (Sims-ISWS)
W77-09706

SEDIMENTATION RATES IN A COASTAL MARSH DETERMINED FROM HISTORICAL RECORDS. State Univ. of New York at Stony Brook. Dept. of Earth and Space Sciences. K. W. Flessa, K. J. Constantine, and M. K. Cushman.
Chesapeake Science, Vol 18, No 2, p 172-176, June 1977. 4 fig, 22 ref.

Descriptors: *Sedimentation rates, *Salt marshes, *Peat, *Sediments, *Vegetation, *New York, On-site investigations, Marshes, Wetlands, Coastal marshes, Saline water, Tidal marshes, Sampling, History, Organic matter, Sedimentation, Sedimentation rates, Gravel, Sands, Sedimentology.
Identifiers: *Flax Pond Marsh(NY), *Long Island(NY), *Long Island Sound.

Historical records indicate that Flax Pond, a small *Spartina alterniflora* marsh located on the north

shore of Long Island, New York, was opened to marine waters in 1803. The opening is recorded in the sediments by a sharp transition from sedge (brackish or freshwater) peat to *Spartina* (salt marsh) peat. The dated horizon was used to calculate an average net rate of vertical accretion of 2.5 mm/yr and a maximum net rate of 4.7 mm/yr. The estimates may serve to predict the rate at which *Spartina* marshes are able to recover from physical disturbance. (Sims-ISWS)
W77-09713

A SIMPLE HAND CORER FOR SHALLOW WATER SAMPLING. Southwest Research Inst., Houston, Tex.
For primary bibliographic entry see Field 7B.
W77-09715

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL. Israel Oceanographic and Limnological Research Ltd., Haifa.
For primary bibliographic entry see Field 5A.
W77-09742

A REPORT ON STUDIES OF THE EFFECTS OF DREDGING AND DISPOSAL IN THE GREAT LAKES WITH EMPHASIS ON CANADIAN WATERS. Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W77-09794

THE EFFECTS OF GRANITIC SAND ON THE DISTRIBUTION AND ABUNDANCE OF SALMONIDS IN IDAHO STREAMS. Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
For primary bibliographic entry see Field 21.
W77-09797

MATFLOOR FOR THE PREVENTION OF HYDRAULIC EROSION.
For primary bibliographic entry see Field 4D.
W77-09798

THE ORIGIN OF HORIZONTAL LAMINAE IN EPHEMERAL STREAM CHANNEL-FILL. Birbeck Coll., London (England). Dept. of Geology; and Birbeck Coll., London (England). Dept. of Geology; L. E. Frostick, and I. Reid.
Sedimentology, Vol. 24, No. 1, p 1-9, February 1977. 4 fig, 31 ref.

Descriptors: *Streams, *Channel morphology, *Sedimentation, *Ephemeral streams, Suspended load, Bed load, Floods, Discharge(Water), Tributaries, Foreign countries, Foreign research, Watersheds(Basins).
Identifiers: *Lamination, *Kenya, *Minerals deposition, Palaeoenvironmental.

Results are presented of an investigation where the sedimentation characteristics in a stream channel from a watershed in Kenya were studied. It was shown that the number of paired horizontal laminae in an ephemeral channel-fill increases systematically down-catchment from stream head-water and is related functionally to tributary confluence. Under moving storm conditions, each tributary subcatchment delivers a sediment-laden discharge pulse that finds sedimentary expression in paired laminae of light and heavy minerals. The lamina differentiation was attributed to a congregational sorting mechanism. The direct relationship between paired laminae and confluent tributaries permits palaeoenvironmental influence of drainage-net character and palaeoclimatic variability. (Bhowmik-ISWS)
W77-09950

URANIUM OXIDATION AND PROBABLE SUBAERIAL WEATHERING OF PHOSPHATIZED LIMESTONE FROM THE POURTALES TERRACE.

Hawaii Inst. of Geophysics, Honolulu.
W. C. Burnett, and D. N. Gomborg.
Sedimentology, Vol. 24, No. 2, p 291-302, April 1977. 4 fig, 3 tab, 28 ref.

Descriptors: *Uranium radioisotopes, *Oxidation, *Limestones, *Phosphates, *Weathering, *Florida, Marine geology, Diagenesis, Freshwater, Karst, Sedimentary petrology, Terraces(Geologic), Submergence, Continental shelf, Sea level, Sampling, Dredging, Isotope studies, Spectrometers.
Identifiers: *Florida Straits, Emergence, Subaerial exposure.

Phosphatized limestones from the Pourtales Terrace, Straits of Florida, have undergone freshwater diagenesis, as shown by several selective petrologic features such as dissolution of aragonitic skeletal material and preservation and recrystallization of Mg-calcite. This interpretation is supported by the fact that greater than 94% of the uranium in the samples is in the U(VI) oxidation state. On the deeper Pourtales Escarpment, phosphatized Limestones show no alteration features indicative of freshwater diagenesis. The uranium in these samples is a mixture of U(IV) and U(VI) with oxidation-state ratios similar to other seafloor phosphorites. The interpretation of the data was that uranium in the terrace samples was oxidized when that area was emergent. The karsted surface of the terrace, therefore, is a result of subaerial exposure of this portion of the Floridan platform. The escarpment samples were never above sea level, and so more closely retain their original uranium oxidation-state ratios. (Visocky-ISWS)
W77-09951

EFFECT OF SLOPE ON THE THRESHOLD OF MOTION AND ITS APPLICATION TO ORIENTATION OF WIND RIPPLES.

Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
A. D. Howard.
Geological Society of America Bulletin, Vol. 88, No. 6, p 853-856, June 1977. 3 fig, 21 ref. NASA NGR-47-005-172.

Descriptors: *Sand waves, *Slopes, Movement, Ripple marks, Shear stress, Sediment transport, Wind erosion, Geology, Winds.
Identifiers: *Wind ripples, Sloping sand surfaces, Friction angles.

On sloping sand surfaces, the downwind perpendicular to ripple crests is not, as is commonly believed, an unbiased indicator of current direction. The ripple-forming creep load is deflected downgradient as a function of the surface gradient, the orientation of the surface relative to the wind, and the friction angle of the sand. The force required to initiate motion on sloping surfaces likewise is dependent upon these parameters. The mean direction of sand movement is also deflected downgradient from the applied fluid force, but by a lesser amount than the ripples. (Lee-ISWS)
W77-09955

HYDRAULICS AND DYNAMICS OF NEW CORPUS CHRISTI PASS, TEXAS: A CASE HISTORY, 1973-75.

Texas Univ. at Austin. Port Aransas. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W77-09982

METHODOLOGY TO EVALUATE ALTERNATIVE COASTAL ZONE MANAGEMENT POLICIES: APPLICATION IN THE TEXAS

COASTAL ZONE, SPECIAL REPORT III: A METHODOLOGY FOR INVESTIGATING FRESH WATER INFLOW REQUIREMENTS OF A TEXAS ESTUARY, VOL I.
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 2L.
W77-10022

WATER COLOR AND CIRCULATION SOUTHERN CHESAPEAKE BAY. PART I. SOUTHERN CHESAPEAKE BAY WATER COLOR AND CIRCULATION ANALYSIS, PART II. SKYLAB MSS VS. PHOTOGRAPHY FOR ESTUARINE WATER COLOR CLASSIFICATION.
Virginia Inst. of Marine Science, Gloucester Point. Applied Marine Science and Ocean Engineering.
For primary bibliographic entry see Field 2L.
W77-10026

REPORT ON A BIOLOGIC AND SEDIMENTOLOGIC STUDY RELATED TO THE TYBEE ISLAND BEACH NOURISHMENT PROJECT AND THE OFFSHORE AREA FOR DREDGE MATERIAL DISPOSAL.
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 2L.
W77-10029

CURRENT DYNAMICS AND SEDIMENT DISTRIBUTION IN THE WEST MISSISSIPPI DELTA AREA.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W77-10032

ANIMAL COLONIZATION OF MAN-INITIATED SALT MARSHES ON DREDGE SPOIL.
North Carolina State Univ., Raleigh. Sea Grant Program.
For primary bibliographic entry see Field 2L.
W77-10035

ESTUARINE SHORELINE EROSION IN THE ALBEMARLE-PAMLICO REGION OF NORTH CAROLINA.
East Carolina Univ., Greenville, N.C. Dept. of Biology; and East Carolina Univ., Greenville, N.C. Dept. of Geology.
For primary bibliographic entry see Field 2L.
W77-10036

THE CAUSES OF EROSION TO SILETZ SPIT, OREGON.
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W77-10039

GRASSING ROADS AND ERODED AREAS IN THE DRAKENSBERG.
Natal Univ., Pietermaritzburg (South Africa). Dept. of Forestry.
For primary bibliographic entry see Field 4D.
W77-10075

2K. Chemical Processes

CONCERNING THE INFLUENCE OF THE HYDROGEN ION CONCENTRATION AND OF THE BICARBONATE CONCENTRATION ON THE STRUCTURE OF BIOMENES OF MOUNTAIN BROOKS. (IN GERMAN).
For primary bibliographic entry see Field 2L.
W77-09620

A QUANTITATIVE METHOD FOR TOXAPHENE BY GC-CI-MS SPECIFIC ION MONITORING.
Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch.
For primary bibliographic entry see Field 5A.
W77-09633

INFLUENCE OF CATION CONTENT ON THE BIOLOGICAL ACTIVITY OF FENSULFOTHION IN PLAINFIELD SAND.
Department of Agriculture, London (Ontario). Research Inst.
For primary bibliographic entry see Field 2G.
W77-09639

NITRITE DECOMPOSITION IN FLOODED SOIL UNDER DIFFERENT PH AND REDOX POTENTIAL CONDITIONS.
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09645

MICROBIAL FORMATION OF VOLATILE SELENIUM COMPOUNDS IN SOIL.
Cornell Univ. Agricultural Experiment Station, Ithaca, N. Y. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09648

COMMENTS ON NITRATE REDUCTION IN UNSATURATED SOIL.
California Univ., Berkeley. Dept. of Soil Biology.
For primary bibliographic entry see Field 2G.
W77-09650

ADSORPTION OF DODECYLBENZENE SULFONATE ON NA(+)-MONTMORILLONITE: EFFECT OF SALT IMPURITIES.
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 2G.
W77-09651

CATION-EXCHANGE CAPACITY OF ACID SOILS USING ALUMINUM CHLORIDE AND BARIUM CHLORIDE-TRIETHANOLAMINE.
Klamath National Forest Yreka, Calif.
For primary bibliographic entry see Field 2G.
W77-09652

INFLUENCE OF IONIC STRENGTH AND INORGANIC COMPLEX FORMATION ON THE SORPTION OF TRACE AMOUNTS OF CD BY MONTMORILLONITE.
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W77-09658

THE EFFECT OF EXCHANGE REACTIONS BETWEEN FRASER RIVER SEDIMENT AND SEAWATER ON DISSOLVED CU AND ZN CONCENTRATIONS IN THE STRAIT OF GEORGIA.
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W77-09707

A DSC (DIFFERENTIAL SCANNING CALORIMETRY) STUDY OF HEAT CAPACITY OF VICINAL WATER IN POROUS MATERIALS.
Miami Univ., Fla.
For primary bibliographic entry see Field 1B.
W77-09734

Field 2—WATER CYCLE

Group 2K—Chemical Processes

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL, Israel Oceanographic and Limnological Research Ltd., Haifa.
For primary bibliographic entry see Field 5A.
W77-09742

DETERMINATION OF ARSENIC SPECIES IN NATURAL WATERS, Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5A.
W77-09747

DETERMINATION OF FREE AND TOTAL POTENTIAL HALOFORMS IN DRINKING WATER, Ontario Ministry of the Environment, Rexdale, Lab. Service Branch.
For primary bibliographic entry see Field 5A.
W77-09748

DETERMINATION OF MOLYBDENUM IN SEA-WATER BY ELECTRON PARAMAGNETIC RESONANCE SPECTROMETRY, New Hampshire Univ., Durham. Dept. of Chemistry.
G. Hanson, A. Szabo, and N. D. Chasteen.
Analytical Chemistry, Vol. 49, No. 3, p 461-463, March, 1977. 3 fig, 14 ref.

Descriptors: *Water analysis, *Sea water, *Molybdenum, *Pollutant identification, *Metals, Water pollution sources, Separation techniques, Analytical techniques, *Spectrophotometry.
Identifiers: *Electron paramagnetic resonance.

An electron paramagnetic resonance method for determining molybdenum in saline waters in the microgram/liter range is described. The method, based on the extraction of paramagnetic Mo(SCN)₅ into isoamyl alcohol, is relatively rapid, requires only 10 ml of sample, and has a detection limit of 0.46 micrograms/liter molybdenum and a relative precision of 4.7% at the 11 microgram/liter level. (Witt-IPC)
W77-09750

AUTOMATED CATALYTIC ULTRAMICRODETERMINATION OF MANGANESE IN NATURAL WATERS WITH A MINIATURE CENTRIFUGAL ANALYZER, Illinois Univ. at Urbana-Champaign. School of Chemical Sciences.
T. P. Hadjiioannou, S. I. Hadjiioannou, J. Avery, and H. V. Malmstadt.
Analytica Chimica Acta, Vol 89, No 2, p 231-239, April, 1977. 18 ref, 3 tab.

Descriptors: *Water analysis, *Pollutant identification, *Manganese, Heavy metals, Metals, Water pollution sources, Trace elements, Centrifugation, Analytical techniques, Spectrophotometry, Water chemistry, Catalysts.

The application of a miniature centrifugal analyzer to trace analysis by kinetic methods has been studied. A spectrophotometric reaction-rate method based on the potassium periodate-diethylaniline reaction which is catalyzed by manganese has been developed. Manganese in the range 0.13-3.4 ng in 45 microliters of sample were determined with relative errors and relative standard deviation of about 2%. The method was applied to the determination of manganese in natural waters. (Witt-IPC)
W77-09753

THE DETERMINATION OF MOLYBDENUM AND TUNGSTEN IN SEA AND SURFACE WATER, Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center.

For primary bibliographic entry see Field 5A.
W77-09754

STANDARDIZATION OF METHYLMERCURY ANALYSIS, Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5A.
W77-09775

GEOCHEMICAL CONTROLS ON TRACE ELEMENT CONCENTRATIONS IN NATURAL WATERS OF A PROPOSED COAL ASH LAND-FILL SITE, Kansas State Univ., Manhattan. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-09928

URANIUM OXIDATION AND PROBABLE SUB-AERIAL WEATHERING OF PHOSPHATIZED LIMESTONE FROM THE POURTALES TERRACE, Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 2J.
W77-09951

MICROBIAL INORGANIC POLYPHOSPHATES: FACTORS INFLUENCING THEIR ACCUMULATION, Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2G.
W77-09965

COMPARISON OF FIVE KINETIC MODELS FOR ORTHOPHOSPHATE REACTIONS IN MINERAL SOILS, Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 2G.
W77-09968

ESTIMATION OF COMPONENTS OF SOIL CATION EXCHANGE CAPACITY FROM MEASUREMENTS OF SPECIFIC SURFACE AND ORGANIC MATTER, University Coll., Dublin (Ireland). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09971

POTASSIUM SOURCES AND AVAILABILITY ON A DEEP, SANDY SOIL OF EAST TEXAS, Texas A and M Univ., College Station. Dept. of Soil Mineralogy.
For primary bibliographic entry see Field 2G.
W77-09972

RELATION BETWEEN THE KINETICS OF NITROGEN TRANSFORMATION AND BIOMASS DISTRIBUTION IN A SOIL COLUMN DURING CONTINUOUS LEACHING, Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 2G.
W77-09973

CHANGES IN THE PHYSICAL PROPERTIES OF SOIL CLAYS DUE TO PRECIPITATED ALUMINUM AND IRON HYDROXIDES: II. COLLOIDAL INTERACTIONS IN THE ABSENCE OF DRYING, Hawaii Univ., Honolulu. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09975

SOLUBILITY AND SOLUBILITY PRODUCT OF DICALCIUM PHOSPHATE DIHYDRATE IN

AQUEOUS SOLUTIONS AND SOIL SOLUTIONS, Alabama Agricultural Experiment Station, Auburn. Dept. of Soils.
For primary bibliographic entry see Field 2G.
W77-09979

THE SLOW REACTION WHICH CONTINUES AFTER PHOSPHATE ADSORPTION: KINETICS AND EQUILIBRIUM IN SOME TROPICAL SOILS, California Univ., Davis. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 2G.
W77-09980

WATER QUALITY PROGRAM OF THE U.S. GEOLOGICAL SURVEY, Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10006

GEOHYDROLOGY OF MUSCATINE ISLAND, MUSCATINE COUNTY, IOWA, Geological Survey, Iowa City, Iowa. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10012

2L. Estuaries

EFFECT OF ORGANIC EXCRETION BY BENTHIC ANNELIDA ON THE PRODUCTIVITY OF PHYTOPLANKTON, Institut Oceanographique, Paris (France). Laboratoire de Physiologie des Etres Marins.
For primary bibliographic entry see Field 5C.
W77-09660

THE TOXICITY OF SODIUM PENTACHLOROPHENOLATE FOR THREE SPECIES OF DECAPOD CRUSTACEANS AND THEIR LARVAE, Amsterdam Univ. (Netherlands). Pharmacological Lab.
For primary bibliographic entry see Field 5C.
W77-09663

ECOLOGICAL RESPONSES OF PHYTOPLANKTON ON CHRONIC OIL POLLUTION, Democritus Nuclear Research Center, Athens (Greece). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-09674

NITROGEN FIXATION IN ARCTIC MARINE SEDIMENTS: EFFECT OF OIL AND HYDROCARBON FRACTIONS, Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W77-09676

ORGANCHLORINE PESTICIDES AND PCBs DISTRIBUTION IN TISSUES OF PURPLE HERON AND SPOON DUCK FROM THE BIOLOGICAL RESERVE OF DONANA (SPAIN), Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Instituto de Quimica Organica General.
For primary bibliographic entry see Field 5A.
W77-09677

NOTE ON THE EFFECTS OF LEAD ON OXYGEN PRODUCTION OF SEVERAL LITTORAL SEaweEDS OF THE ADRIATIC SEA, Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5C.
W77-09682

INDUCTION OF HEPATIC ARYL HYDROCARBON HYDROXYLASE IN SALMON EXPOSED TO PETROLEUM DISSOLVED IN SEAWATER AND TO PETROLEUM AND POLYCHLORINATED BIPHENYLS, SEPARATE AND TOGETHER, IN FOOD, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-09683

SATELLITE-DERIVED GLOBAL OCEANIC RAINFALL ATLAS (1973 AND 1974), National Aeronautics and Space Administration, Greenbelt, Goddard Space Flight Center.
For primary bibliographic entry see Field 7C.
W77-09693

SHALLOW MARINE SAND BAR SEQUENCES: AN EXAMPLE FROM THE LATE PRECAMBRIAN OF NORTH NORWAY, Oxford Univ. (England). Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 2J.
W77-09699

SHORT TERM VARIABILITY IN VERTICAL CHLOROPHYLL STRUCTURE, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
K. L. Denman.
Limnology and Oceanography, Vol 22, No 3, p 434-441, May 1977. 5 fig, 1 tab, 22 ref.

Descriptors: *Chlorophyll, *Surveys, Profiles, *Temporal distribution, Bays, Biomass, Zooplankton, Phytoplankton, Sampling, Tides, Tidal effects, Temperature, Water temperature, Depth, Variability, Estuaries, *Canada.
Identifiers: *St. Margaret's Bay (Nova Scotia), *Vertical profiles (Chlorophyll).

A 26-h series of vertical profiles of chlorophyll a and temperature, one every 15 min, was obtained during 22-23 April 1974 in 35 m of water in St. Margaret's Bay, Nova Scotia. From the original profiles, derived contour plots, and spectral analysis of the series, it appears that the temporal changes in the vertical structure resulted mainly from tidal advection. Of the several simple parameters examined, the average chlorophyll and the maximum chlorophyll over the profile were the best indices of changes in the vertical structure. The most commonly used parameter, chlorophyll concentration at fixed depth, was shown to be readily contaminated by internal waves and, therefore, makes a poor indicator of changes representative of the whole chlorophyll layer. (Sims-ISWS)
W77-09702

SEASONAL VARIATION IN TEMPERATURE, SALINITY, AND DENSITY OVER THE CONTINENTAL SHELF OFF OREGON, Oregon State Univ., Corvallis. School of Oceanography.
A. Huyer.
Limnology and Oceanography, Vol 22, No 3, p 442-453, May 1977. 9 fig, 1 tab, 27 ref. NSF ID071-04211, OCE76-00594.

Descriptors: *Continental shelf, Hydrography, *Coasts, *Oregon, *Pacific Ocean, *Salinity, Temperature, *Water temperature, *Density, Surveys, Profiles, On-site investigations, Seasonal, Variability, Oceans, Currents (Water), Ocean currents, Upwelling, Oceanography.

Seasonal variations in the hydrography of the waters over the continental shelf off Oregon were observed in a set of hydrographic data collected along 44 deg 39 min N at intervals of a few weeks to a few months from 1961 through 1970. The temperature is determined only partly by the local heating and cooling cycle: at the surface it is low (9 C) in winter, increasing in spring, lowest in summer, highest in early fall, and decreasing in winter; near the bottom, it is highest in winter and lowest in summer. The summer minimum is associated with coastal upwelling and a strong southward geostrophic current. Variations in salinity are governed by runoff, both locally and through the Columbia River effluent, as well as by coastal upwelling and advection. Neither temperature nor salinity is negligible in determining sigma-t. In summer, sigma-t decreases with distance offshore, and isopycnals slope downward from shore; in winter, sigma-t increases with distance offshore, and isopycnals slope upward from shore. Steric sea level also slopes downward from the coast in winter, and upward in summer. Alongshore geostrophic flow is southward in summer and northward in winter. The variations in temperature, salinity, and sigma-t are caused by seasonal cycles in the surface heat balance, precipitation and runoff, the local wind, and the alongshore flow. (Sims-ISWS)
W77-09703

SEDIMENT TRANSPORT AND DEPOSITION AT RIVER MOUTHS: A SYNTHESIS, Sydney Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W77-09705

NORTH ATLANTIC ICE-RAFTING: A MAJOR CHANGE AT 75,000 YEARS BEFORE THE PRESENT, Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 2J.
W77-09706

THE EFFECT OF EXCHANGE REACTIONS BETWEEN FRASER RIVER SEDIMENT AND SEAWATER ON DISSOLVED CU AND ZN CONCENTRATIONS IN THE STRAIT OF GEORGIA, British Columbia Univ., Vancouver. Inst. of Oceanography.
D. J. Thomas, and E. V. Grill.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 421-427, May 1977. 4 fig, 2 tab, 14 ref.

Descriptors: *Zinc, *Copper, *Dissolved solids, *Estuaries, *Canada, Sediments, Heavy metals, Rivers, Coasts, Sea water, Saline water-freshwater interfaces, Chemical properties, On-site investigations, Sampling, Chemical analysis, Pollutants, Path of pollutants, Water pollution.
Identifiers: *Fraser River, *Strait of Georgia, *British Columbia.

Dissolved Cu and Zn measurements were made on water samples collected in the Strait of Georgia off the mouth of the Fraser River between May 1973 and May 1974. Large increases in the concentration of both metals were observed in the spring and early summer, the period of maximum water and sediment discharge from the river. The increases, which are not attributable to the dissolved metals found in the river water, evidently were caused by the desorptive exchange reactions that occur when Fraser River sediment mixes with seawater. Such a mechanism is consistent with the results of experimental desorption measurements made on the sediment and with the metal distribution patterns observed in the strait. (Sims-ISWS)
W77-09707

A MODEL OF THE ANNUAL CYCLE OF TEMPERATURE IN A FRONTAL REGION OF THE CELTIC SEA, Institute of Oceanographic Sciences, Birkenhead (England).
I. D. James.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 339-353, May 1977. 8 fig, 2 tab, 22 ref.

Descriptors: *Water temperature, *Oceans, *Model studies, Mathematical models, Meteorological data, Tides, Tidal effects, Temperature, Humidity, Winds, Solar radiation, Eddies, Turbulence, Annual, Currents (Water), Oceanography.
Identifiers: *Celtic Sea, *Irish Sea, Annual cycles.

A numerical model was devised to predict the annual cycle of the temperature structure of the water column given the tidal current and the meteorological variables wind speed, dew point, and solar radiation. The model indicated the occurrence of a front between well-mixed and stratified water which has been observed in the Celtic Sea. (Sims-ISWS)
W77-09708

ESTIMATING THE WATER AND SALT BUDGETS OF A STRATIFIED ESTUARY, Helsinki Univ. (Finland). Dept. of Geophysics.
J. Virta.
Nordic Hydrology, Vol 8, No 1, p 11-32, 1977. 6 fig, 4 tab, 15 ref.

Descriptors: *Estimating, *Estuaries, *Hydrologic budget, *Salts, *Salt balance, Estuarine environment, Tides, Tidal waters, Salinity, Temperature, Summer, Winter, Foreign countries, Foreign research.
Identifiers: *Baltic Sea, *Finland, *Pohjanpitajalanlahti Bay (Finland), *Salt budget, Tidal range, Low salinity, Shallow sill, Salinity stratification.

The characteristic features of some estuaries along the coast of the Baltic Sea are: small tidal range, low salinity, moderate temperature and salinity stratification during summer which become weaker during winter, abundant freshwater inflow, and connection through a shallow sill with the adjacent sea. The flow and transport of salt in the upper and lower layers of the outlet of an estuary of this type was determined. First, the magnitude of the terms of the transport equations were estimated, using the analogy between the transport of salt and heat. Then, the important terms of the transport equation were computed with a model which was based on the measured slope of the water level and on the water budget of the estuary. Testing was carried out by comparing the measured and computed salt contents of the estuary. The operation of the model on Pohjanpitajalanlahti Bay in southern Finland was found to be satisfactory. (Roberts-ISWS)
W77-09709

EXPERIENCES WITH THE USE OF THE AEROLOGICAL METHOD IN EVAPORATION STUDIES IN NORTHWESTERN EUROPE, Helsinki Univ. (Finland). Dept. of Meteorology.
For primary bibliographic entry see Field 2D.
W77-09710

SEDIMENTATION RATES IN A COASTAL MARSH DETERMINED FROM HISTORICAL RECORDS, State Univ. of New York at Stony Brook. Dept. of Earth and Space Sciences.
For primary bibliographic entry see Field 2J.
W77-09713

A MODEL OF DYNAMICS IN THE LOWER POTOMAC RIVER ESTUARY, State Univ. of New York at Stony Brook. Marine Sciences Research Center.

Field 2—WATER CYCLE

Group 2L—Estuaries

R. E. Wilson.
Chesapeake Science, Vol 18, No 2, p 177-187,
June 1977. 11 fig, 16 ref.

Descriptors: *Dynamics, *Estuary,
*Currents(Water), *Model studies, Mathematical
models, Density, Tidal effects, Tides, Equations,
Hydrodynamics, Water levels, Hydrostatic pres-
sure, Salinity, Velocity, Flow, Mixing, Rivers,
*Virginia.
Identifiers: *Lower Potomac River Estuary(Va).

A simple two-dimensional numerical model was developed to represent the observed vertical structure of tidal and nontidal currents and tidal elevations along a reach of the lower Potomac River Estuary. The model was based on a linearized longitudinal momentum equation and a laterally averaged continuity equation. The model incorporates the effects of a naturally varying channel cross section through the continuity equation, and a seaward increase in density through the pressure gradient term in the momentum equation. The observed distribution of density in the reach is used to evaluate the horizontal pressure gradient relative to the water surface. The model utilized a coefficient of vertical eddy viscosity which varies both vertically and longitudinally. With but two adjustable parameters associated with the eddy viscosity, good agreement was obtained between the computed and observed tidal and nontidal currents. (Sims-ISWS)
W77-09714

A SIMPLE HAND CORER FOR SHALLOW WATER SAMPLING,
Southwest Research Inst., Houston, Tex.
For primary bibliographic entry see Field 7B.
W77-09715

FISHING CHARACTERISTICS OF A MISSISSIPPI DEAD-END CANAL SYSTEM,
University of Southern Mississippi, Hattiesburg,
Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-09721

THREE-LAYER CIRCULATIONS IN ESTUARIES AND HARBORS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences; and Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
R. R. Long.
Journal of Physical Oceanography, Vol. 7, No. 3, p 415-421, May 1977. 6 fig, 10 ref. ONR N00014-75-C-0805.

Descriptors: *Water circulation, *Harbors,
*Estuaries, *Model studies, Mathematical models,
Hydraulic models, Laboratory tests, Density, Cir-
culation, Salinity, Stratification, Density stratifi-
cation, Coasts, Tidal waters.
Identifiers: *Three-layer circulation.

A theory was developed for the three-layer circulation in an overmixed estuary (finite freshwater inflow) or harbor (zero freshwater inflow) accompanying a two-layer structure in the large body of water outside. A determinate set of algebraic equations was derived for the general case, and the form of the equations shows that for zero freshwater inflow, the discharge q sub 1 from a harbor is proportional to the square root of the density difference between the two outside fluids. The problem is solved completely when there is a uniform depth H of the fluids inside and outside the harbor, when the freshwater inflow is zero, and when the two layers of fluid outside the harbor are of equal thicknesses. The solution showed that the outflowing layer of water has a thickness $d=H/2$ and a flux q sub 1 = HW sq rt (H Delta b sub o)/8, where W is the width at the constriction and Delta b sub o the buoyancy difference between the two outside layers of water. A laboratory model

reproduced the three-layer circulation of the theory. The outflowing fluid was quite turbulent, which made the observation of the layer thickness uncertain, but the thickness appeared to be close to the value $d=H/2$ of the theory. (Sims-ISWS)
W77-09723

GEOCHEMICAL INTERACTIONS OF HEAVY METALS IN SOUTHEASTERN SALT MARSH ENVIRONMENTS,
Skidway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5B.
W77-09767

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL OF DEEP-SEA SEDIMENT BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-09772

MESENCHYMAL TUMORS OF SOME ESTUARINE FISHES IN THE NORTHERN GULF OF MEXICO. II. SUBCUTANEOUS FIBROMAS IN THE SOUTHERN FLOUNDER, PARALICHTHYS LETHOSTIGMA, AND THE SEA CATFISH, ARIUS FELIS,
Gulf Coast Research Lab., Ocean Springs, Miss.
For primary bibliographic entry see Field 5C.
W77-09780

HEAVY METAL TOLERANCE OF MARINE PHYTOPLANKTON. II. COPPER TOLERANCE OF THREE SPECIES IN DIALYSIS AND BATCH CULTURES,
Norwegian Inst. of Seaweed Research, Trondheim.
For primary bibliographic entry see Field 5C.
W77-09781

SUPERSATURATION OF ATMOSPHERIC GASES IN THE COASTAL WATERS OF THE GULF OF MAINE,
National Marine Fisheries Service, West Boothbay Harbor, Maine. Biological Lab.
For primary bibliographic entry see Field 5C.
W77-09793

OCEANOGRAPHIC WATER SAMPLER,
For primary bibliographic entry see Field 7B.
W77-09799

MOTOR POWERED BY WAVE ACTION,
For primary bibliographic entry see Field 8C.
W77-09803

STERIODS AS SEWAGE SPECIFIC INDICATORS IN NEW YORK BIGHT SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5A.
W77-09901

A MATHEMATICAL MODEL FOR WATER QUALITY IN A COASTAL REGION IN TERMS OF SEA BOTTOM WASTE DEPOSITS (KAITEI OSENBUSSHITSU NADO NO EIKYO O KORYO SHITA KAIKI NO SUISHITSU NO YOSOKU-MODERU NO KAIHATSU NI KANSURU KEN-KYU),
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 5B.
W77-09911

THE EFFECT OF COASTAL HYDRODYNAMICS ON THE ECHINODERM DISTRIBUTION IN

THE SUBLITTORAL OF OXWICH BAY, BRISTOL CHANNEL,
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
P. A. Tyler, and F. T. Banner.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 293-308, May 1977. 7 fig, 57 ref.

Descriptors: *Benthic fauna, *Bays,
*Hydrodynamics, Surveys, Sampling, Sediments,
Sands, Particle size, Marine animals, Benthos,
Coasts, Tidal waters, Circulation, Water circula-
tion, Waves(Water), Distribution patterns, Biolo-
gy, Estuaries.
Identifiers: *Oxwich Bay(Wales), *Bristol Chan-
nel(Wales), *Echinoderms, Ophiuroids.

The distribution of some benthic echinoderms (particularly ophiuroids) was studied in Oxwich Bay; and approaches, in relation to the dynamic and physical oceanography and the resultant dynamic sedimentology of the Bay also were studied. It was concluded that those species which possess planktonic larvae have an adult distribution which correlates with the distribution of modern (not relict) fine sediment and that both correlate with the energy distribution of the hydrodynamic regime, as the settlements of both fine sediment and newly metamorphosed meroplanktonic echinoderms are subject to the same physical laws. The echinoderm distribution is modified by adult migratory activity and itself exerts an effect on community structure in the Bay. (Sims-ISWS)
W77-09944

TRANSMISSION SPECTROSCOPY EXAMINATIONS OF NATURAL WATERS-C. ULTRAVIOLET SPECTRAL CHARACTERISTICS OF THE TRANSITION FROM TERRESTRIAL HUMUS TO MARINE YELLOW SUBSTANCE,
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
For primary bibliographic entry see Field 5A.
W77-09945

ENTRAINMENT VELOCITY IN NATURAL STRATIFIED VERTICAL SHEAR FLOW,
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
G. Kullenberg.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 329-338, May 1977. 2 fig, 2 tab, 15 ref, 1 append.
W77-09946

Descriptors: *Mixing, *Entrainment, *Coasts,
*Estuaries, On-site investigations, Laboratory tests, Model studies, Turbulence, Winds, Density, Salinity, Flow, Shear, Stratification, Tracers, Tracking techniques, Dye releases, Rhodamine, Dye concentrations, Oceanography.
Identifiers: *Entrainment velocity.

The entrainment velocity was determined from mixing experiments in coastal waters with a well-mixed upper layer separated from a lower layer by a well-defined pycnocline. The experiments were carried out during conditions of strong winds. The dependence of the entrainment velocity upon the wind velocity and the density jump across the pycnocline was found to conform with reported results obtained by means of shear flow laboratory experiments. The essential parameter is an overall type Richardson number. On the other hand, the ratio of the vertical transfer coefficients for mass and momentum is found to depend upon the local Richardson number. The change of potential energy due to the entrainment is related to the energy input from the wind, which leads to an estimate of the critical flux Richardson number which conforms with reported results. (Sims-ISWS)
W77-09946

DEEP WATER RENEWAL AND ASSOCIATED PROCESSES IN NORTH NORWAY,
Tromsø Museum (Norway). Marine Biological Station.

S. Skreslet, and H. Loeng.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 383-398, May 1977. 11 fig, 7 tab, 13 ref.

Descriptors: *Water circulation, *Fjords, *Inflow, Temperature, Water temperature, Density, Foreign countries, Foreign research, Salinity, Currents(Water), Estuaries, Current meters, Movement, Circulation, Seasonal, Tides, Tidal effects, Water transfer, Coasts.
Identifiers: *Norway.

In Skjomen, a 156 m deep fjord with a 60 m sill depth at the entrance, renewal of the basin water occurs annually, during winter. Dilution and heating of outside waters during summer prevents inflow, but estuarine circulation inside the fjord dilutes the basin water and makes it exchangeable when the density of outside water increases. Dominant seaward winds during winter lift deep water outside the sill and cause it to flow into the basin at intervals throughout the winter and spring. Other processes like turbulent diffusion of salt from the basin water towards the surface, cooling of water over the sill, and tidal currents, possibly also bring about and/or enhance inflows. (Sims-ISWS)

W77-09947

THE BOTTOM MIXED LAYER ON THE CONTINENTAL SHELF,

Institute of Oceanographic Sciences, Wormley (England).

R. D. Pingree, and D. K. Griffiths.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 399-413, May 1977. 11 fig, 2 tab, 12 ref.

Descriptors: *Continental shelf, *Water temperature, *Mixing, *Atlantic Ocean, Tides, Tidal effects, On-site investigations, Surveys, Temperature, Profiles, Density, Salinity, Heat transfer, Energy, Oceanography.
Identifiers: *Bottom mixing layers, *English Channel, *Celtic Sea.

The height of the bottom mixed layer of the continental shelf was defined as the height above bottom where the mean potential temperature exceeds the bottom value by 0.01°C. Direct measurements of vertical current shear and temperature structure indicated that in this region the production of turbulent energy is much greater than the stabilizing effect of the heat flux down the potential temperature gradient. Detailed temperature profiles with a resolution of 0.001°C suggested that the controlling parameters for the potential temperature gradient are the friction velocity and the downward heat flux. (Sims-ISWS)

W77-09948

INTERACTIONS BETWEEN ZINC AND SUSPENDED SEDIMENTS IN THE FRASER RIVER ESTUARY, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Geological Sciences.

For primary bibliographic entry see Field 5B.
W77-09949

URANIUM OXIDATION AND PROBABLE SUBAERIAL WEATHERING OF PHOSPHATIZED LIMESTONE FROM THE POURTALES TERRACE,

Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 2J.
W77-09951

EFFECT OF SLOPE ON THE THRESHOLD OF MOTION AND ITS APPLICATION TO ORIENTATION OF WIND RIPPLES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

For primary bibliographic entry see Field 2J.
W77-09955

HYDRAULICS AND DYNAMICS OF NEW CORPUS CHRISTI PASS, TEXAS: A CASE HISTORY, 1973-75,

Texas Univ. at Austin. Port Aransas. Marine Science Inst.
R. L. Watson, and E. W. Behrens.
U.S. Army Coastal Engineering Research Center, Fort Belvoir, VA, GITT Report 9, September 1976. 175 p, 43 fig, 11 tab, 6 append, 20 ref.

Descriptors: Hydraulics, *Sedimentation, *Sediment transport, *Tides, *Waves(Water), *Texas, Tidal waters.
Identifiers: *Corpus Christi Pass(Tex), *Tidal currents, *Tidal inlets.

A case history of the hydraulics and sedimentation of the Corpus Christi Water Exchange Pass, Texas, primarily from 1973 to 1975 is presented. This pass, and the larger Aransas Pass, connect Corpus Christi Bay with the Gulf of Mexico. Quantitative data on longshore sediment transport, tidal differentials across the pass, flood and ebb tidal discharge, wind waves, and local winds explain most of the bathymetric changes which have occurred in the flood tidal delta, baymouth shoreline, channel, gulf mouth, bar bypassing system, and the adjacent Gulf of Mexico beaches. Dominant onshore winds produce gulf setup and bay setdown such that, with the exception of the duration of anticyclonic events with north winds, the pass is highly flood-dominated. Heavy surf in the pass mouth and the longshore bars sweeping around the short jetties provide the gulf mouth with a large sediment supply which must be flushed by tidal discharge if the pass is to remain open. Flood dominance combined with a long channel require that most of the littoral drift entering the channel be carried through its entire length to be deposited on the flood tidal delta rather than be returned seaward by ebb flow. (WES)

W77-09982

EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE PERU-CHILE TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A. W. Garcia.
Research Report H-76-2, September 1976. 44 p, 23 fig, 2 tab, 1 append, 17 ref.

Descriptors: *Earthquakes, *Tsunamis, *Mathematical models, *Pacific Coast region, Coasts, *Pacific Ocean, *South America, Simulation analysis.
Identifiers: *Peru-Chile Trench(So Amer).

An idealized axis of the Peru-Chile Trench was divided into 12 segments of equal length. A hypothetical bottom displacement which generates a tsunami with intensity approximately equal to four was centered in three of the segments. An explicit finite difference numerical code was used to simulate generation and propagation of the resulting tsunami to the west coast of the continental United States. Additionally, the tsunami of 22 May 1960 was simulated and comparison made to gage records at selected open coast locations along the U.S. Pacific Coast. Contour plots of surface elevation of the few leading waves of the tsunami at selected times are presented. An analytical technique is used to normalize the amplitude of the leading wave of the tsunami to its amplitude at 600-ft water depth. For purposes of comparison, the amplitudes of the tsunami generated in each segment are plotted as a function of distance along the Pacific coast from the Mexican to the Canadian border. These plots allow an evaluation of the relative vulnerability of coastal locations to tsunamis generated in different locations of the Peru-Chile Trench. (WES)

W77-09983

STABILITY OF RUBBLE-MOUND BREAK-WATER JUBAIL HARBOR, SAUDI ARABIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 8B.
W77-09984

COMPUTATION OF UNSTEADY FLOWS IN RIVERS AND ESTUARIES BY THE METHOD OF CHARACTERISTICS,
Geological Survey, Reston, VA. Water Resources Div.

For primary bibliographic entry see Field 2E.
W77-09993

LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY; REPORT 4, MODEL DESIGN,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 8B.
W77-10016

CHARLESTON HARBOR NAVIGATION STUDY, SOUTH CAROLINA, VERIFICATION TESTS; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10019

METHODOLOGY TO EVALUATE ALTERNATIVE COASTAL ZONE MANAGEMENT POLICIES: APPLICATION IN THE TEXAS COASTAL ZONE, SPECIAL REPORT III: A METHODOLOGY FOR INVESTIGATING FRESH WATER INFLOW REQUIREMENTS OF A TEXAS ESTUARY, VOL I,
Texas Univ. at Austin. Center for Research in Water Resources.

W. P. Lambert, and E. G. Furr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 182, Price codes: A21 in paper copy, A01 in microfiche. National Science Foundation, Research Applied to National Needs (RANN) Report No NSF/RA-760258, 1976. 479 p. AEN7413590A01.

Descriptors: Water resources, *Estuaries, *Water quality control, *Texas, *Methodology, Ecology, Management, *Inflow.
Identifiers: *Coastal zone management, *Freshwater inflow.

The water resource management problem of determining fresh water inflow requirements for a Texas estuary were studied. A computer-oriented methodology was developed for assessing those requirements. The methodology provided a general, rational approach to the inflow problem without being dependent upon specific machines and computer programs. Viability of the methodology was demonstrated using existing computer models within an estuarine management scenario developed for Corpus Christi Bay, Texas. The methodology has a two-step structure. STEP 1 translates qualitative, ecologically-oriented management policy goals for an estuary into a set of net fresh water inflow requirements. STEP 2 produces the set of upstream fresh water release schedules required to satisfy those net inflow requirements. Execution of STEP 1 depends on the identification of a set of indicator organisms which characterize the desired estuarine environment. Control parameter behavior within the estuary is modeled on a computer. Inputs to STEP 2 include legal, sociological, physical, hydrologic, and meteorologic characteristics of the upstream region and surface water user community. (Sinha-OEIS)

W77-10022

Field 2—WATER CYCLE

Group 2L—Estuaries

THE GEORGIA COASTAL ENVIRONMENT. A COMPILATION OF RESOURCE MATERIALS COVERING THE COASTAL PLAIN, ESTUARIES AND OFFSHORE WATERS.
Army Engineer District, Wilmington, N.C.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 176. Price codes: A08 in paper copy, A01 in microfiche. 1975. 162 p, 838 ref. H. W. Dubach (Compiler).

Descriptors: *Georgia, *Coasts, *Bibliographies, *Estuaries, Water resources, Baseline studies, Resources development, Southeast US, Estuarine environment.
Identifiers: *Outer continental shelf.

This bibliography represents an effort on the part of the Wilmington District Corps of Engineers to facilitate the availability of information relating to the coastal environment. Although efforts are concentrated on Georgia, references to North Carolina, South Carolina and Florida are frequent. It is recognized that environments conform to the boundaries of nature more than to the boundaries of man's institutions. Information relating to the Georgia coastal environment can be effectively utilized in other areas of the Atlantic Coast either by gaining regional perspective or through application of relevant principles contained in the work. (Sinha-OEIS)
W77-10025

WATER COLOR AND CIRCULATION SOUTHERN CHESAPEAKE BAY. PART I. SOUTHERN CHESAPEAKE BAY WATER COLOR AND CIRCULATION ANALYSIS, PART II. SKYLAB MSS VS. PHOTOGRAPHY FOR ESTUARINE WATER COLOR CLASSIFICATION.
Virginia Inst. of Marine Science, Gloucester Point. Applied Marine Science and Ocean Engineering. M. M. Nichols, and H. H. Gordon.
Available from the National Technical Information Service, Springfield, VA 22161 as NASA CR-141404. Price codes: A07 in paper copy, A01 in microfiche. Special Report No 96, October 1975. 134 p, 25 ref.

Descriptors: *Color, *Circulation, Water resources, *Baseline studies, *Water quality, *Water properties, *Chesapeake Bay, Aerial photography, Sediment transport, Satellites(Artificial), Estuaries, Remote sensing.
Identifiers: Satellite imagery, Coastal zone, Bottom topography.

Satellite imagery from two EREP passes over the Rappahannock Estuary of the Chesapeake region are analyzed to chart colored water types to delineate color boundaries and define circulatory patterns. Surface observations from boat and helicopters concurrently with Skylab overpass, define the distributions of suspended sediment, transparency, temperature, salinity, phytoplankton, color of suspended material and optical ratio. Important features recorded by the imagery are a large-scale turbidity maximum and massive red tide blooms. Water movement is revealed by small-scale mixing patterns and tidal plumes of apparent sediment-laden water. The color patterns broadly reflect the bottom topography and the seaward gradient of suspended material between the river and the Bay. Analyses of red, green and natural color photos by microdensitometry demonstrates the utility of charting water color types of potential use for managing estuarine water quality. The Skylab imagery is superior to aerial photography and surface observations for charting water color. The imagery acquired is a valuable contribution to the study of coastal zone processes and management. (Sinha-OEIS)
W77-10026

REPORT ON A BIOLOGIC AND SEDIMENTOLOGIC STUDY RELATED TO THE TYBEE

ISLAND BEACH NOURISHMENT PROJECT AND THE OFFSHORE AREA FOR DREDGE MATERIAL DISPOSAL.
Skidaway Inst. of Oceanography, Savannah, Ga. G. F. Oertel.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-025 221. Price codes: A06 in paper copy, A01 in microfiche. Final Report to the Savannah District of the Corps of Engineers, December 1975. 121 p, 12 fig, 8 tab, 6 append. DACW-21-75C-0007.

Descriptors: *Georgia, *Beaches, *Sediment transport, *Environmental effects, *Baseline studies, *Aquatic life, Sedimentation.
Identifiers: *Beach nourishment, Dredge spoil, Spoil banks.

The Tybee Island beach nourishment project produced two major physical changes at the foreshore. At the north end of the island, adjacent to Fort Screven, an 800 foot terminal groin was constructed. Before groin construction currents were approximately shore parallel. After groin construction, currents were directed toward the groin at decreased velocities. The nourishment project also produced a complete burial of the eroding foreshore surface of Tybee Island. The quantity of sediment transport in the nearshore zone is dependent upon the velocity of the longshore tidal current and the quantity of sand suspended by wave activity. In an offshore area for the disposal of dredged material, nektonic and benthic surveys were made before, during and after the 1974 disposal operation. The benthic infauna illustrated communities associated with a coarse grained ridge and a finegrained trough or swale. Fish that were feeding at or on the bottom were affected to a greater extent by seasonal changes than they were by the deposition of dredged material. In fact, during the disposal operation, the number of bottom feeding fish was higher at the disposal area than in the control. The turbidity associated with the disposal operation may have had an apparent attractive effect on the fish with bottom associated feeding characteristics. (Sinha-OEIS)
W77-10029

THREE-LAYER CIRCULATIONS IN ESTUARIES AND HARBORS.
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
R. R. Long.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-031 282. Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 8 (Series C), September 1976. 23 p, 6 fig, 10 ref. N00014-75-C-0805.

Descriptors: *Estuaries, *Circulation, *Model studies, Water resources, *Water circulation, *Harbors, Salinity, *Mixing.

A theory is developed for the three-layer circulation in an overmixed estuary (finite fresh-water inflow) or harbor (zero fresh-water inflow) accompanying a two-layer structure in the large body of water outside. A determinate set of algebraic equations is derived for the general case and the form of the equations shows that for zero fresh-water inflow the discharge from a harbor is proportional to the square root of the density difference between the two outside fluids. The problem is solved completely when there is a uniform depth of the fluids inside and outside the harbor, when the fresh-water inflow is zero and when the two layers of fluid outside the harbor are of equal thicknesses. A laboratory model reproduced the three-layer circulation of the theory. The outflowing fluid was quite turbulent and this made the observation of the layer thickness uncertain but it appeared to be close to the value of the theory. (Sinha-OEIS)
W77-10030

EVALUATION OF UTILITY EQUIPMENT FOR HARBOR OIL SPILL REMOVAL/RECOVERY SYSTEMS.
Civil Engineering Lab. (Navy), Port Hueneme, Calif.
For primary bibliographic entry see Field 5G.
W77-10031

CURRENT DYNAMICS AND SEDIMENT DISTRIBUTION IN THE WEST MISSISSIPPI DELTA AREA.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

S. P. Murray, and W. J. Wiseman, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-025 547. Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 208, June 1976. 9 p, 2 ref. Also as Reprint from Conference on Marine and Freshwater Research in Southern Africa, July, 1976, Port Elizabeth, South Africa. N00014-75-C-0192.

Descriptors: *Deltas, *Sedimentation, *Settling velocity, *Gulf of Mexico, *Mississippi River, Tidal effects, Winds, Seasonal, River flow.

The dynamical oceanography (currents, waves, tides, density structure) of the coastal bight west of Southwest Pass, an area extending roughly 50 km offshore and 70 km alongshore, was studied intensively during the hydrologic year 1973-1974. The sediment pattern appears to be largely controlled by the mean current field produced by seasonal wind and river discharge effects. For example, distinct zones of (1) low wood-fiber content, (2) high percentage of occurrence of silt, and (3) low percentage of occurrence of clay are associated with the region affected by the intrusion of Gulf water. These sediment distributions can be explained in terms of the interaction of particle settling velocities with the tidal current dispersion and a topographically induced clockwise vortex in the near-surface layer overriding an intrusion of heavy Gulf water in the central core. (Sinha-OEIS)
W77-10032

OIL AND GAS SEEPS IN ALASKA. ALASKA PENINSULA, WESTERN GULF OF ALASKA.
Bureau of Mines, Anchorage, Alaska. Alaska Field Operation Center.
For primary bibliographic entry see Field 5B.
W77-10033

SIMULATION FACTORS INVOLVED IN OCEAN THERMAL POWER PLANTS.
Naval Academy, Annapolis, Md. Dept. of Naval Systems Engineering.
For primary bibliographic entry see Field 5B.
W77-10034

ANIMAL COLONIZATION OF MAN-INITIATED SALT MARSHES ON DREDGE SPOIL.
North Carolina State Univ., Raleigh. Sea Grant Program.
L. M. Cammen, E. D. Seneca, and B. J. Copeland.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-028 345. Price codes: A04 in paper copy, A01 in microfiche. U.S. Army Coastal Engineering Research Center, Technical Paper No 76-7, June 1976. 60 p, 12 fig, 11 tab, 50 ref.

Descriptors: *Salt marshes, *Stabilization, *North Carolina, Dredging.
Identifiers: *Dredge spoils, *Spartina alterniflora, Animal colonization, Smooth cordgrass.

Dredge spoil (sand and mud scooped from the bottom of navigation routes and piled high on channel edges) has been successfully stabilized with plantings of North Carolina's dominant marsh grass, *Spartina alterniflora*. Benefits of stabilizing spoil with *Spartina*, commonly known as smooth

cordgrass, appear to be twofold. In the short term, marsh grass slows erosion of spoil back into the waterways, thereby reducing the need for frequent and costly dredging with its wear and tear on the environment. In the long term, areas covered with Spartina come to look like natural marshlands. Marsh provides a vital source of nutrients and food for many young fish and shellfish and is, therefore, important to fishery resources. Research shows that planting Spartina on dredge spoil can lead to the creation of salt marsh that resembles marsh built by nature. How long this takes depends on how closely spoil resembles the natural marsh sediment, the natural sedimentation rate of the area, the elevation and the maturity of the natural marsh compared to the area of spoil deposition. (Sinha-JEIS)
W77-10035

ESTUARINE SHORELINE EROSION IN THE ALBEMARLE-PAMLICO REGION OF NORTH CAROLINA

East Carolina Univ., Greenville, N.C. Dept. of Biology; and East Carolina Univ., Greenville, N.C. Dept. of Geology.
V. Bellis, M. P. O'Connor, and S. R. Riggs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 257. Price codes: A04 in paper copy, A01 in microfiche. North Carolina State University, Raleigh, Sea Grant Program, Publication no UNC-SG-75-69, December 1975. 76 p, 40 fig, 4 tab, 15 ref. Sea Grant 04-3-158-40.

Descriptors: *Estuaries, *Shore protection, *Erosion, *Bank erosion, *North Carolina, Bank stability.
Identifiers: *Albemarle-Pamlico region(NC).

Shoreline erosion within the estuaries of North Carolina is a continuing process which has been in operation for several thousand years. Actual rates of erosion range up to twenty feet per year but average 2-3 feet per year. Variables affecting rate of shoreline erosion are: bank height and composition, vegetative cover, exposure to prevailing winds and fetch, offshore topography, and various human activities. Three major shoreline types are identified on the basis of these parameters. These are: sand and clay banks, swamp forest, and grass marsh. Of these shoreline types only the sand and clay banks can be easily developed. All types, however, can be protected by shoreline modification structures, utilization of natural protective features, or appropriate setback regulation. (Sinha-OEIS)
W77-10036

A DYNAMIC WATER QUALITY MODEL FOR THE NEUSE ESTUARY, N.C.

North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-10037

THE CAUSES OF EROSION TO SILETZ SPIT, OREGON

Oregon State Univ., Corvallis. Dept. of Oceanography.
P. D. Komar, and C. C. Rea.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 663. Price codes: A02 in paper copy, A01 in microfiche. Sea Grant College Program Publication No ORESU-T-75-001, December 1975. 20 p, 15 fig.

Descriptors: *Oregon, *Erosion, *Rip currents, Coastal engineering, Landfills.
Identifiers: *Siletz Spit(Ore).

Severe erosion occurred on Siletz Spit on the central Oregon coast in the winter of 1972-73. No jetties are present at the Siletz Bay inlet. Instead, the erosion is associated with rip currents, strong narrow currents that flow across the surf zone to out

beyond the breakers. Rip currents erode embayments on the beach, at time cutting back into the dunes on which the houses were built. Because conditions similar to Siletz Spit occur elsewhere on the Oregon coast, such episodes of erosion could be repeated. Documenting the erosion to Siletz Spit and explaining its causes may help prevent this. (Sinha-OEIS)
W77-10039

LONG BEACH HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS; REPORT 2, ALTERNATE PLANS FOR PIER J COMPLETION AND TANKER TERMINAL PROJECT

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10040

LONG BEACH HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS; REPORT 4, ALTERNATE PLANS FOR PIER J COMPLETION AND TANKER TERMINAL PROJECT (NO LANDFILL)

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10041

LOS ANGELES HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10042

THE EFFECT OF COPPER ON COMPETITION BETWEEN MARINE ALGAE

Manchester Polytechnic (England). Dept. of Chemistry and Biology.
For primary bibliographic entry see Field 5C.
W77-10051

OLIGOCHAETA OF THE DNIESTER RIVER MOUTH REGION, (IN RUSSIAN)

Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.
T. G. Moroz, and N. R. Pavlova.
Zool Zh 54(4), p 613-616, 1975.

Descriptors: *Oligochaetes, *Estuaries, *Salinity, *Population, Benthic fauna, Biomass, Benthos.
Identifiers: Dniester River estuary, River mouth, USSR, Euryhaline species, Population density.

The oligochaete fauna in the Dniester estuary is represented by freshwater freshwater-euryhaline, brackish-water and marine species, their ratios being different in different parts of the estuary and dependent on salinity. The increase of insalinity of the Dniester River mouth region (USSR) will probably decrease the population density of oligochaetes and diminish their role in the total benthic biomass.
W77-10065

PARTIAL ANALYSIS OF THE MICROPLANKTON IN THE LAGOON OF PUEBLO VIEJO, STATE OF VERA CRUZ, MEXICO, (IN SPANISH)

Instituto Nacional de Pesca, Mexico City.
R. Mirna Cruz.
Rev Soc Mex Hist Nat 34, p 327-368, 1973 (1975).

Descriptors: *Lagoons, *Oysters, *Plankton, *Food abundance, *Diets, Estuaries, Reproduction, Phototropism, Oxygen requirements, Diatoms, Foods, Larvae, Chlorella, Aquatic microorganisms, Aquatic productivity, Bacteria.
Identifiers: Balanus sp., Biddulphia sp., Cocconeis sp., Coscinodiscus sp., Crassostrea virginica, Mexico, Pueblo viejo, Rhizosolenia, Synedra sp., Veracruz.

This lagoon is considered an estuary with environmental conditions favoring oysters, among other species of commercial importance. A study was made using 125 samples of plankton and 1250 water samples. Information on the season of reproduction of the oyster, *Crassostrea virginica* Gm., and the extent of the period of fixation of its larvae is presented. Larvae of the oyster and of *Balanus* sp. are present almost throughout the year. For both species maximal values were present from June-Sept. There is another short season during part of Dec. and Jan. Studies of fixation of larvae on tiles indicated that oyster larvae have a negative phototropism and apparently thrive under low O₂ concentrations; hence bottom fixation is most abundant. The larvae of *Balanus* sp. show positive phototropism requiring high O₂ concentrations, which is why they were most abundant near the surface. The stomach contents of the oysters include fragments of *Coscinodiscus* sp., *Synedra* sp., *Cocconeis* sp. and *Biddulphia* sp. Oysters larvae fed on various organisms like *Chlorella*, small flagellates 2-3 microns in size, and bacteria. Also 32 genera of diatoms were identified, including *Coscinodiscus* sp., *Biddulphia* sp., *Rhizosolenia* and others.
W77-10066

WISSELWERKING TUSSEN LAND EN ZEE, OF, DIE EKOLOGIE VAN DIE KUSWATERS VAN NATAL (THE INTER-ACTION BETWEEN LAND AND SEA, OR, THE ECOLOGY OF THE COASTAL WATERS OF NATAL)

Natal Univ., Durban (South Africa).
A. E. Heydorn.
Tegnikon, Vol. 24, No. 3, p 3-7, September 1976. 5 ref.

Descriptors: Ecology, Estuaries, Marine biology, Coastal structures, Currents(Water), Sea water.
Identifiers: *Natal(South Africa).

The ecology of the coastal waters of Natal is characterized by a large variety of environmental parameters such as a dominant southward flowing current of tropical origin, a cooler and less pronounced inshore counter-current from the south, a land mass which slopes steeply from the Drakensberg to the coast, a large number of rivers and estuaries entering the sea, high summer rainfall etc. A situation of pronounced interaction between land and sea exists and the biota of the coastal waters are closely adapted to this specialized environment. Sensitivity in the utilization of the coastal region is vital, particularly with regard to harbor-, industrial-, property-, and agricultural development, if damage to the environment upon which the sea's natural resources depend, is to be avoided. If adequate care is not taken, the danger of development of one facet at the expense of another is substantial, and to avoid this danger effective communication between developers and engineers on the one hand and biologists and ecologists on the other, must be given high priority. (So. African Water Info Ctr)
W77-10072

A CHECK LIST AND NOTES ON THE BIRDS OF SANDVIS, SOUTH WEST AFRICA

South African Div. of Nature Conservation and Tourism, Etosha, Ecological Inst.
H. H. Berry, and C. U. Berry.
Madoqua, Vol. 9, No. 2, p 5-18, 1975. map, 6 fig, 11 ref, 2 tab.

Descriptors: *Water birds, Taxonomy, Population, *Estuarine environment, Ecosystems, Migration, Breeding, Saline water, Salt marshes, Limnology, Algae, Food chains, Africa.
Identifiers: Flamingoes, Pelicans, Sea-birds, Palaearctic waders, Cormorants, *Sandvis Bay, Sandwich Harbour, South West Africa, South Africa.

Sandvis (23 deg 20'S, 14 deg 30'E) covers an area of 20 sq km and is approximately 10 km north-

Field 2—WATER CYCLE

Group 2L—Estuaries

south by a maximum of 3 km east-west. It is isolated from the interior of South West Africa by the great sand dunes of the coastal Namib Desert and bounded by the Atlantic Ocean on the west. The nearest other vegetation of any consequence is in the delta of the Kuiseb River, 25 km NE. During the course of two years of bird population counts at Sandviss (previously also known as Sandwich Harbour) from July 1970 to June 1972 it was possible to compile a systematic list of the species. In addition, confirmed sightings made by visitors to the area since 1968 have been included. A previous record of species found at Sandviss exists and it has been referred to when a species seen or collected at that time was not encountered during the period 1970-1972. Dixon (1970) has also collected some hitherto unrecorded species in the area. Prozesky recorded 66 species of birds during the course of two visits to the area (May 1959 and January 1960). To date the number of species recorded is 113 and represents an exceptionally wide taxonomic variety when the isolated nature of the area is taken into account. (So African Water Info Center) W77-10089

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DISTILLATION APPARATUS AND METHOD,
J. E. Pottharst, Jr.
U. S. Patent No. 4,002,538, 9 p, 8 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 952, No 2, p 769, January 11, 1977.

Descriptors: *Patents, *Distillation, *Vapor compression distillation, *Desalination, Brackish water, Sea water, Water purification, Water quality control, Separation techniques, Equipment, Water pollution treatment.

A vapor compression type distillation apparatus and method is provided for distilling brackish water or seawater so that increased efficiency can be achieved by virtue of an arrangement and operation which maximizes the average effective temperature differential between steam being condensed and the water being vaporized. Thus a vertical shell and tube vaporizer is provided which includes an array of tubes which has a width substantially greater depth. The liquid discharged from the upper ends of the tubes is caused to flow downward in a downtake passage into a body of water at the lower end of the vaporizer along the entire width of the array. Feed water is fed into the body of water at the lower end of the vaporizer at one end of the array and blowdown is taken from the other end of the array. (Sinha - OEIS) W77-09804

REGULAR COPOLYAMIDES AS DESALINATION MEMBRANES,
Department of the Interior, Washington, D.C. Office of the Secretary.
O. F. Vogl, and D. R. Stevenson.
U.S. Patent No. 4,002,563, 5 p, 1 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 777, January 11, 1977.

Descriptors: *Patents, Desalination, *Desalination processes, *Reverse osmosis, Separation techniques, Water purification, *Membrane processes, Chemical reactions, *Membranes.
Identifiers: Aliphatic copolyamides membranes.

Efficiency of the reverse osmosis process depends to a large extent on the nature of the membrane. Superior desalination membranes may be prepared from regular copolyamides. It has been found that aliphatic regular copolyamides can be prepared by reacting an aliphatic diester with an excess of an

aliphatic diamine, and subsequently reacting the intermediate diamine diamide product with an aliphatic diacid chloride. Or, the diamine diamide may be reacted with an aromatic diacid chloride to form a product in which R in the formula is an aromatic radical. Reactions involved in preparation of the copolyamides of the invention are illustrated, in which the reactants are ethylene diamine, diethylxalate and an aliphatic or aromatic diacid chloride. (Sinha-OEIS) W77-09806

SEMI-IMPERMEABLE MEMBRANES AND THE METHOD FOR THE PREPARATION THEREOF,

Department of the Interior, Washington, D.C. Office of the Secretary.
W. J. Wrasidlo.
U.S. Patent No. 4,005,012, 6 p, 3 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1656, January 25, 1977.

Descriptors: *Patents, *Membrane processes, *Semi-permeable membranes, *Reverse osmosis, Water treatment, Water purification, Chlorine, *Desalination, Waste water treatment, Filtration.

When utilizing the semi-permeable membranes in the treatment of brackish water, and particularly in the treatment of waste effluent, it is often necessary to treat the feed material with chlorine or other oxidizing agents so as to guard against bacterial growth. However it has also been found that when chlorine has been included in the feed there is a substantial deterioration in the performance of the membrane. This invention relates to semi-permeable membranes which are useful in reverse osmosis or ultra-filtration processes which possess desirable characteristics of being resistant to deterioration due to the presence of chlorine in the feed fluid. A composite semi-permeable membrane is comprised of a microporous substrate and an ultra-thin film having semi-permeable properties deposited on one surface of the microporous substrate. The ultra-thin film is formed by contacting an aqueous solution of an amine modified polyepihalohydrin with a solution of a polyfunctional agent which is capable of reacting with the amine groups. (Sinha-OEIS) W77-09817

EVALUATION OF CELLULOSE ACETATE MEMBRANES FOR REVERSE OSMOSIS SEPARATION,
National Environmental Engineering Research Inst., Nagpur (India).
For primary bibliographic entry see Field 5D. W77-09863

APPLICATION OF MEMBRANE PROCESSES,
Permutit Co., Paramus, N. J.
H. B. Sliger, and R. Quinn.
Desalination, Vol 19, p 573-586, December 1976. 3 fig, 5 tab.

Descriptors: *Membrane processes, *Desalination plants, *Reverse osmosis, *Desalination processes, *Operation and maintenance, *Economic efficiency, Operating costs, Capital costs, Pumps, Fouling, Systems analysis.
Identifiers: Hollow fiber permeator, Spiral wound membrane, Tubular membrane, In-line coagulation.

Factors to consider in selecting the optimum membrane and assembling it in an efficient hardware system are outlined. Operating and application parameters for the three basic membrane configurations (spiral wound, hollow fiber and tubular systems) are presented, including information on specific trade products. All three membrane systems have advantages and drawbacks, and the job of a membrane systems application engineer is to select the appropriate membrane for a given application. The size of the element assembly and the

limits imposed by the recovery levels determine the economics for a particular system. The system must be single-staged if the water to be treated has a high solids content or has saturation limits for a given constituent. The system used in most applications involves two stages in which the reject from the first stage is the feed to the second. The choice of pump is also important. To optimize the economics of pretreatment, some form of in-line coagulation should be used, if possible. Some examples are given to demonstrate the variety of options for membrane installations. (Jahns-Arizona) W77-09929

COLORADO RIVER BASIN SALINITY CONTROL PROJECT--TITLE I,
Bureau of Reclamation, Yuma, Ariz. Yuma Projects Office.
For primary bibliographic entry see Field 5D. W77-09931

3B. Water Yield Improvement

ICE NUCLEATION BY MICAS,
Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
For primary bibliographic entry see Field 2B. W77-09956

3C. Use Of Water Of Impaired Quality

CHANGE OF SALINITY WITH DIFFERENT DISTANCES BETWEEN DRAINS UNDER CONDITIONS OF NORTHERN MUGAN, (IN RUSSIAN),
A. A. Mamedov.
Izv Akad Nauk Az SSR Ser Biol Nauk 3, p 69-73. 1975.

Descriptors: *Saline soils, *Drainage, *Drains, Agriculture, *Land reclamation, Salinity, Desalination.
Identifiers: *USSR(Northern Mugan), Azerbaijan SSR, Kura River(USSR), Araks River(USSR).

In the northern Mugan, a plain south of the confluence of the Kura and Araks rivers in the Azerbaijan SSR (USSR) the saline soils are improved by different intensities of draining. Distances between drains are 200, 300, 400, 500, 600, 700, 800 and more meters. Under the actual conditions of reclamations and development of the saline lands the rate of desalinization of the soils does not depend on the distance between drains within 200-700 m. Consequently, in the given case with consideration of actual farming practice, greater distances between drains, up to 600-700 m, can be used in the collector-drainage network.--Copyright 1976, Biological Abstracts, Inc. W77-09630

INFLUENCE OF CATION CONTENT ON THE BIOLOGICAL ACTIVITY OF FENSULFOTHION IN PLAINFIELD SAND,
Department of Agriculture, London (Ontario). Research Inst.
For primary bibliographic entry see Field 2G. W77-09639

SULFUR-COATED FERTILIZERS FOR SUGARCANE: I. PLANT RESPONSE TO SULFUR-COATED UREA,
Florida Univ. Belle Glade. Dept. of Plant Nutrition.
For primary bibliographic entry see Field 3F. W77-09640

SULFUR-COATED FERTILIZERS FOR SUGAR-CANE: II. RELEASE CHARACTERISTICS OF SULFUR-COATED UREA AND KCl.
Florida Univ. Belle Glade. Dept. of Plant Nutrition.
For primary bibliographic entry see Field 3F.
W77-09641

AMMONIA VOLATILIZATION AND NITROGEN UTILIZATION FROM SULFUR-COATED UREAS AND CONVENTIONAL NITROGEN FERTILIZERS.
Texas A and M Univ., Corpus Christi. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 3F.
W77-09642

EFFECT OF LEACHING FRACTION ON RIVER SALINITY.
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 5G.
W77-09697

THE EFFECTS OF WATER CONTENT OF THE TOPSOIL ON MICRONUTRIENT AVAILABILITY AND UPTAKE IN A SILICEOUS SANDY SOIL.
Adelaide Univ. (Australia). Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09930

LONG-TERM EVALUATION OF SLOW-RELEASE NITROGEN SOURCES OF TURF-GRASS.
Community Coll. of the Finger Lakes, Canandaigua, New York.
D. V. Waddington, E. L. Moberg, J. M. Duich, and T. L. Watschke.
Soil Science Society of America Journal, Vol. 40, No. 4, p 593-597, July-August 1976. 5 fig, 2 tab, 3 ref.

Descriptors: *Turf grasses, *Kentucky bluegrass, *Ureas, *Nitrogen, Nutrients, Fertilization, Crop response, Crop production.
Identifiers: Slow-release nitrogen, Turfgrass yield.

Short-term studies with slow-release nitrogen sources have not provided information on the changes in response that may occur with continued use of a given material. In this study eight nitrogen sources were used to fertilize 'Merion' Kentucky bluegrass for 7 consecutive years to obtain long-term results. Fertilizers used were urea, Uramite (urea form), IBDU (isobutylidene diurea), Urex (urea-paraffin matrix), ADM (plastic coated urea), Milorganite (activated sewage sludge), and two complete (NPK) fertilizers, with two-thirds of the nitrogen from ureaform or IBDU and the remainder soluble. Urea was applied every other week and the other fertilizers were applied one, two or three times per season to obtain total N of 1.46, or 2.44 kg/100 sq m. Weekly clipping yields and color ratings were used to evaluate turfgrass response to the fertilizer treatments. Milorganite, Uramite, and IBDU produced more uniform growth than Urex, ADM, and the complete fertilizers. Response to Urex, ADM, and the complete fertilizer with IBDU was similar, and was often characterized by excessive growth after application. The greatest increase in response with continued use occurred with Uramite, which was the least efficient fertilizer in the first two years. At the end of the 7-year period, determinations of yield, color, and total soil N indicated that Uramite had the greatest residual effect. (Skogerboe-Colorado State)
W77-09978

3D. Conservation In Domestic and Municipal Use

URBAN RUNOFF POLLUTION CONTROL-TECHNOLOGY OVERVIEW.
Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
For primary bibliographic entry see Field 5D.
W77-09823

STORM WATER MANAGEMENT MODEL: LEVEL I-COMPARATIVE EVALUATION OF STORAGE-TREATMENT AND OTHER MANAGEMENT PRACTICES.
Florida Univ., Gainesville. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 5D.
W77-09824

AN APPROACH TO REDUCE WATER CONSUMPTION IN NEIGHBORHOODS THROUGH REUSE.
Sir Venkateswara Univ., Tirupati (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-09855

NATIONWIDE EVALUATION OF COMBINED SEWER OVERFLOWS AND URBAN STORM-WATER DISCHARGES. VOLUME II: COST ASSESSMENT AND IMPACTS.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5D.
W77-09874

3E. Conservation In Industry

A UNIQUE MEANS OF OBTAINING SEAWATER.
South West African Consolidated Diamond Mines Ltd., Oranjemund.
For primary bibliographic entry see Field 8E.
W77-09692

TREATMENT OF DENIM TEXTILE MILL WASTEWATERS: NEUTRALIZATION AND COLOR REMOVAL.
Noonan (R.S.), Inc. of South Carolina, Greenville.
For primary bibliographic entry see Field 5D.
W77-09724

RELATIONSHIP OF EFFLUENT LIMITATIONS TO FUTURE PULP MILL CLOSURES.
Environmental Protection Agency, Seattle, Wash.
For primary bibliographic entry see Field 5D.
W77-09727

FIBERBOARD MILL RECYCLES WATER.
For primary bibliographic entry see Field 5D.
W77-09728

BROWN (CO.) RECYCLES DE-INKING WATER ON TISSUE-GRADE PRODUCTS.
For primary bibliographic entry see Field 5D.
W77-09732

APPLICATION OF REVERSE OSMOSIS AND ULTRAFILTRATION TO THE PURIFICATION OF PULP AND PAPER INDUSTRY EFFLUENTS (ZASTOSOWANIE ODWROCONEJ OSMOZY I ULTRAFILTRACJI DO OCZYSZCZANIA SCIEKOW Z PRZEMYSŁU CELULOZOWO-PIAPIERNICZEGO).
Instytut Inżynierii Ochrony Środowiska Politechniki Śląskiej, Gliwice (Poland).
For primary bibliographic entry see Field 5D.

W77-09733

HOW TO REDUCE WATER AND RAW MATERIAL CONSUMPTION IN PAPERMAKING (COME RIDURRE I CONSUMI D'ACQUA E DI MATERIE PRIME IN CARTIERA).
Cartiere Ambrogio Binda S.p.A., Milan (Italy).
D. Corbetta, and G. Testori.
Industria della Carta, Vol. 14, No. 12, p 528-545, December, 1976. 7 fig, 13 ref, 5 tab.

Descriptors: *Pulp and paper industry, *Water conservation, Industrial water, Water consumption (Except consumptive use), Costs, *Water pollution control.
Identifiers: Paper machines.

After a brief introduction to data concerning the cost of process water supplies and the specific water consumption involved in the production of various grades of pulp and paper, criteria for the selection of measures to be used in reducing process water consumption in papermaking are outlined. Examined in particular is the conservation of process water in the primary, secondary, and tertiary water circulation systems of paper machines, as well as reductions in the consumption of wash water, cooling water, general-services water, and sanitary water. (Speckhard-IPC)
W77-09738

CLOSED-CYCLE MILL ELIMINATES POLLUTION WHILE ALSO SAVING MONEY.
C. F. Cornell.
In: Evaluating New Paper Technology from a Capital Budgeting Viewpoint (Seminar sponsored by First Manhattan Co., N.Y.), p 14-20, September 21, 1976. 1 tab.

Descriptors: *Water conservation, *Pulp and paper industry, *Water pollution control, *Pulp wastes, Wastes, Industrial wastes, Water pollution sources, Foreign countries, *Canada, *Costs, Water consumption, Industrial water, Pollution abatement, Economics, Capital costs, *Water pollution treatment, Discharge (Water), *Recycling, *Water reuse.
Identifiers: *Kraft mills, Closed systems, Chemical recovery.

The closed-cycle 250,000 ton/year bleached market kraft pulp mill of Great Lakes Paper Co. Ltd. in Thunder Bay, Ontario, is the first practical installation utilizing Envirotech's salt recovery process (SRP). Estimated annual operating cost savings of nearly \$4,500,000 are expected to accrue from heat savings (including decreased steam consumption and increased steam production from reclaimed organics), fiber and chemical savings, water savings, reduced effluent treatment costs, and yield increases. Within 2-3 years these economies are expected to pay for the about \$8,000,000-9,000,000 greater capital investment compared to a conventional new kraft mill without external effluent treatment (which could, however, equal or double this amount). Only 4000 gallons of water are used per ton of pulp, ca. 85% less than in conventional kraft mills. Concurrent reuse of filtrates plus other modifications reduce steam demands in the bleaching to ca. 10-15% of those normally required. Clean clear cooling water is the only liquid discharge from the mill, and water pollution is no longer a problem. (Brown-IPC)
W77-09740

ACTIVATED CARBON ADSORPTION PROCESS FOR PURIFICATION OF TEXTILE WASTE WATERS.
McGill Univ., Montreal (Quebec). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W77-09744

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3E—Conservation in Industry

CHARACTERIZATION AND TREATMENT OF TEXTILE DYEING WASTEWATERS, Crompton and Knowles Corp., Reading, Pa. For primary bibliographic entry see Field 5D. W77-09745

WATER REUSE IN A PAPER REPROCESSING PLANT, Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science. For primary bibliographic entry see Field 5D. W77-09757

PAPER MILL WASTEWATER TREATMENT BY MICROTRAINING, Strathmore Paper Co., Turners Falls, Mass. For primary bibliographic entry see Field 5D. W77-09758

TREATING WOOD PRESERVING PLANT WASTEWATER BY CHEMICAL AND BIOLOGICAL METHODS, Environmental Science and Engineering, Inc., Gainesville, Fla. For primary bibliographic entry see Field 5D. W77-09759

IMPACT OF MUNICIPAL WATER AND SEWAGE CHARGES ON INDUSTRY, Packard and Anderson Engineers, Auburn, N. Y. For primary bibliographic entry see Field 5G. W77-09921

3F. Conservation in Agriculture

SULFUR-COATED FERTILIZERS FOR SUGARCANE: I. PLANT RESPONSE TO SULFUR-COATED UREA, Florida Univ. Belle Glade. Dept. of Plant Nutrition. G. J. Gascho, and G. H. Snyder. Soil Science Society of America Journal, Vol. 40, No. 1, p 119-122, January-February 1976. 1 fig, 2 tab, 14 ref.

Descriptors: *Fertilizers, *Fertilization, *Sugarcane, Ureas, Nutrients, *Crop response, Crop production, Nitrogen, Soils, Plant growth, Growth rates, Florida.
Identifiers: Sulfur-coated ureas(Soils).

Crop growth and yield on sand soils is often limited by low N availability due to leaching losses from soil. This study was initiated to determine if sulfur-coated urea (SCU) could supply adequate N nutrition and eliminate the need for repeated N applications for sugarcane grown on previously uncropped Immokalee fine sand in southern Florida. Single applications of two SCU's were compared with split applications of (NH₄)₂SO₄(AS), each at three N rates, 56, 112, and 168 kg/ha. Application of SCU at planting in November resulted in excellent growth and high leaf N concentrations in the spring but did not provide optimum N throughout the growing season. Leaf N concentrations in late summer and tonnages of sugarcane and sugar for SCU plots approached, but did not equal, those attained with four applications of AS. Higher tonnages were recorded for the slower releasing SCU than for the faster releasing source but both SCU sources released large amounts of N before the warm summer months when N is required in the highest quantities. The data indicate that SCU's which release N more slowly and/or later application date should provide better N nutrition and eliminate the need for several split applications of soluble sources. (See also W77-09641) (Skogerboe-Colorado State) W77-09640

SULFUR-COATED FERTILIZERS FOR SUGARCANE: II. RELEASE CHARACTERISTICS OF SULFUR-COATED UREA AND KCl, Florida Univ. Belle Glade. Dept. of Plant Nutrition. G. H. Snyder, and G. J. Gascho. Soil Science Society of America Journal, Vol. 40, No. 1, p 122-126, January-February 1976. 4 fig, 2 tab, 11 ref.

Descriptors: *Nitrogen, *Potassium, *Fertilizers, *Fertilization, Leaching, Nutrients, Soils, Crop production, Florida, Chlorides.
Identifiers: *Sulfur-coated ureas(Soils).

Nitrogen release from sulfur-coated urea and K release from S-coated KCl were examined by several techniques under field conditions in three south Florida sand soils in order to assist in the interpretation of plant response data and to provide insight into the use of three slow-release fertilizer materials. Decreased thickness of S coating, higher temperatures and higher moisture generally favored nutrient release. However, considering the range of field conditions involved in the studies, variations in N and K release were comparatively small. Release was rapid during the first 6 months, averaging 70-80% of that applied, but was much slower thereafter. (See also W77-09640) (Skogerboe-Colorado State) W77-09641

AMMONIA VOLATILIZATION AND NITROGEN UTILIZATION FROM SULFUR-COATED UREAS AND CONVENTIONAL NITROGEN FERTILIZERS, Texas A and M Univ., Corpus Christi. Agricultural Research and Extension Center. J. E. Matocha. Soil Science Society of America Journal, Vol. 40, No. 4, p 597-601, July-August 1976. 2 fig, 2 tab, 17 ref.

Descriptors: *Ammonia, *Nitrogen, *Ureas, Nutrients, *Fertilization, Calcareous soils, Acidic soils, Cation exchange, Corn(Field), Lime, Fertilizers.
Identifiers: *Ammonia volatilization, *Sulfur-coated ureas(Soils).

Ammonia volatilization was measured on acid and calcareous soils receiving sulfur-coated ureas (SCU) and highly soluble N fertilizers. Surface and mixed applications of SCU-30 (30% dissolution rate), SCU-20 (20% dissolution rate), uncoated (NH₂)₂CO, (NH₄)NO₃, and (NH₄)₂SO₄ were made with and without lime to a fallowed acid fine sand. Without lime, top dressed (NH₄)NO₃, SCU-20, SCU-30, and (NH₄)₂SO₄ lost < 1% while (NH₂)₂CO lost 18.5% of added N in 14 days. Topdressing lime with N caused more NH₃ loss from (NH₄)₂SO₄ than from (NH₂)₂CO during the initial 48 hours. However, accumulative losses for 14 days were 51.5, 22.5, 9.0, and 1.7% from (NH₂)₂CO, (NH₄)₂SO₄, SCU-30 and SCU-20, respectively. Incorporating the lime with the soil prior to N addition reduced NH₃ loss > 50% as compared to surface application, but mixing N with the limed acid soil did not reduce NH₃-N losses. Mixing SCU with the soil appeared to increase release rate of N over topdressing, but this effect was not detected in plant response. Nitrogen uptake by corn on the acid soil substantiated some of the conclusions regarding measured NH₃-N losses. Ammonia losses from N mixed with the finer textured calcareous clay loam were generally insignificant. Surface applied (NH₂)₂CO and (NH₄)₂SO₄ lost significant amounts of NH₃-N while losses from SCU and (NH₄)NO₃ were negligible. (Skogerboe-Colorado State) W77-09642

EFFECT OF PRETREATMENT ON LOSS OF NITROGEN-15-LABELLED FERTILIZER NITROGEN FROM WATERLOGGED SOIL DURING INCUBATION, Prairie View A and M Coll., Tex.

For primary bibliographic entry see Field 2G. W77-09643

EVALUATION OF THE PARAMETERS OF SOIL PHOSPHORUS AVAILABILITY FACTORS IN PREDICTING YIELD RESPONSE AND PHOSPHORUS UPTAKE, University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science. For primary bibliographic entry see Field 2G. W77-09646

EFFECTS OF BORON AND NITROGEN ON GRAIN YIELD AND BORON AND NITROGEN CONCENTRATIONS OF BARLEY AND WHEAT, Department of Agriculture, Charlottetown (Prince Edward Island). Research Station. U. C. Gupta, J. A. MacLeod, and J. D. E. Sterling. Soil Science Society of America Journal, Vol. 40, No. 5, p 723-726, September-October 1976. 5 tab, 12 ref.

Descriptors: *Boron, *Nitrogen, *Wheat, *Barley, Crop production, Crop response, Grains(Crops), Soils, Water pollution sources, Toxicity.

In field experiments, 4.48 kg B/ha added to soil decreased the grain yield of barley and wheat. Under greenhouse conditions, 0.5 ppm, added B reduced wheat yields while 1.0 ppm added B reduced barley yields. The B toxicity in wheat in 1974 and barley and wheat in 1975 at 2.24 kg B/ha as associated with reduced yield was alleviated somewhat by the additions of N to the soil in field experiments, but the effect was not significant. Under greenhouse conditions, additions of 50 ppm N or more reduced B uptake and alleviated B toxicity. In general, the B toxicity symptoms on the foliage under field conditions were associated with > 11 ppm B in wheat boot stage tissue (BST) and > 14 ppm B in BST of barley. Added B increased the N concentration of grain where yields were decreased due to B toxicity. Wheat yields increased with increased rates of N application in all field experiments, while barley yields increased with increased rates of N in 2 of the 3 years. In field experiments the highest B value was 34 ppm. Concentrations as high as 312 ppm B were found in greenhouse experiments. In the presence of added B under greenhouse conditions, the barley tissue B concentration was much lower when the moisture level near the fertilizer band was low than when it was high. (Skogerboe-Colorado State) W77-09655

PHOSPHORUS-ZINC INTERACTION IN RELATION TO ABSORPTION RATES OF PHOSPHORUS, ZINC, COPPER, MANGANESE, AND IRON IN CORN, Haryana Agricultural Univ., Hissar (India). Dept. of Soils. N. M. Safaya. Soil Science Society of America Journal, Vol. 40, No. 5, p 719-722, September-October 1976. 4 tab, 24 ref.

Descriptors: Nutrients, Fertilization, *Phosphorus, *Zinc, *Copper, *Manganese, *Iron, Corn(Field), Crop production, Crop response, *Absorption, Fertilizers, Soils.

The effects of P and Zn on growth, nutrient content in tops and roots, and the rates of absorption of P, N, Cu, Mn, and Fe per unit fresh weight of roots for two growth periods of corn were studied in soil culture under greenhouse conditions. Visual symptoms of Zn deficiency appeared in plants when the level of applied P was raised to 75 micro g P/g soil. Phosphate decreased tissue-Zn concentration and Zn flux through roots. Zinc deficient plants had higher concentration of P in their tissues. Phosphate flux was mostly reduced with Zn, but during 27-48 days growth, Zn-supplied plants retained near identical rates of P absorption

(approximately 14 micro g/g fresh root/day) irrespective of the level of P supplied. The rate of Cu absorption was reduced with both P and Zn as the plants aged. Manganese flux was initially stimulated by P but later on drastically reduced by Zn. Iron concentration in plants decreased with Zn application but significant reduction in Fe flux with Zn occurred during early growth of 25 ppm P-supplied plants only. In general, nutrient fluxes diminished with plant age. (Skogerboe-Colorado State)
W77-09656

CALCIUM AND STRONTIUM ABSORPTION BY CORN ROOTS IN THE PRESENCE OF CHELATES,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
G. L. Malzer, and S. A. Barber.
Soil Science Society of America Journal, Vol. 40, No. 5, p 727-731, September-October 1976. 3 fig, 3 tab, 13 ref.

Descriptors: *Strontium, *Calcium, *Corn(Field), Crop production, *Absorption, Plant growth, *Chelation, Root development, Root systems, Soils.
Identifiers: *Cation absorption(Plants), *Chelate absorption(Plants).

While chelates have been shown to increase the flux of metal cations into roots, the mechanism has been subject to question. The objective of this research was to characterize the action of chelates on metal cation absorption. Calcium and Sr rather than micronutrient metals were used because some plant roots do not discriminate in their absorption, hence, relative flux of Ca vs. Sr could be used to evaluate uptake mechanisms. The chelates used were: EDTA, DPTA, and HEDTA. Flux into corn roots was determined by monitoring Ca, Sr, and chelate depletion from solution with time. Double labeling of Ca and Sr with Ca-45 and Sr-85 was used. Ligand concentrations were measured using Cd titration, C-14-labeling, and UV-absorption measurements of Cu-ligand complexes. Calcium and Sr were removed from solution more rapidly than the chelate. Only 11 to 16% of the chelating ligand was absorbed over a 5-day period, whereas 90% or more of each of Ca and Sr was absorbed. The Ca/Sr ratio of uptake indicated that some of the Ca and Sr was absorbed directly from the chelate. However, where Ca(2+) was maintained by continual addition, chelated Ca appeared relatively unavailable to the plant. (Skogerboe-Colorado State)
W77-09657

THROUGH THE ANDES.

For primary bibliographic entry see Field 8A.
W77-09687

TEMPORALLY AND AREALLY DISTRIBUTED RAINFALL,
Agricultural Research Service, Athens, Ga. Southeast Watershed Lab.
For primary bibliographic entry see Field 2B.
W77-09696

THE FUNCTIONAL AND AESTHETIC USES OF TWO CACHE VALLEY, UTAH, CANALS,
Utah State Univ., Logan. Dept. of Landscape Architecture and Environmental Planning.
For primary bibliographic entry see Field 6B.
W77-09796

GROVE IRRIGATION SYSTEM,

E. A. McLeod.
U. S. Patent No. 4,002,294, 8 p, 8 fig, 17 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 690, January 11, 1977.

Descriptors: *Patents, *Irrigation, *Distribution systems, *Irrigation systems, *Irrigation efficiency, Application equipment, Filters, Water distribution(Applied).

In an irrigation system for use in a citrus grove, water is pumped from a well into a chamber of an elongated filter which has an outer casing and an inner treating unit defining the chamber. The filter also has a spigot and valve for flushing the filter. Irrigation water goes in one end, through the filter, passing from the chamber into the treating unit and out the other end to a main line. The main line supplies sub-main and branch lines to T-shaped pipes which terminate in posts. Each post has a vertical pipe which emerges from the post and has a spraying head designed to be just above the post. The T-shaped pipes are placed so that the posts will emerge on both sides of a tree trunk and spray water from both sides onto the tree trunk to feed the roots. (Sinha - OEIS)
W77-09800

SELF-REGULATING SPRINKLER,

M. Drori.
U. S. Patent No. 4,002,295, 4 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 690-691, January 11, 1977.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Water delivery, Application equipment, Flow control, Irrigation efficiency.

A pressure-regulated water sprinkler includes a sprinkler head carrying a nozzle at one end through which the water discharges in the form of a jet. A housing defines an internal chamber connected at one end with the nozzle and having an inlet at another end. The nozzle end of the housing is formed with internal ribs spaced circumferentially and extending longitudinally to a point within the chamber intermediate the nozzle and inlet ends. The ribs are formed with a first annular shoulder adjacent to the nozzle end of the chamber and with a second annular shoulder of larger diameter. An annular ring within the chamber has one side bearing against the second annular shoulder and its opposite side facing the housing inlet. A regulator is placed within the chamber between the ring and first annular shoulder. A pressure-sensing means automatically moves the regulator member towards and away from one side of the annular ring to regulate the flow to the nozzle. (Sinha - OEIS)
W77-09801

ROTARY SPRINKLER PARTICULARLY FOR USE WITH LOW-ENERGY WATER JETS,

M. Drori.
U. S. Patent No. 4,002,296, 4 p, 4 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 691, January 11, 1977.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, *Irrigation efficiency, Jets, Application equipment, Water delivery(Applied).

A rotary sprinkler particularly for use with low-energy water jets comprises an arrangement where the forward stroke of its oscillating arm is used to rotate the sprinkler head, the oscillating arm being returned to its normal position during the return stroke without applying sufficient force against the sprinkler head to rotate it. (Sinha - OEIS)
W77-09802

UNDERGROUND IRRIGATION POROUS PIPE,

Ballas (George C.), Houston, Tex. (Assignee).
J. E. Turner.
U. S. Patent No. 4,003,408, 7 p, 8 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 954, no 3, p1064, January 18, 1977.

Descriptors: *Patents, *Irrigation, *Irrigation effects, *Subsurface irrigation, Soil-water-plant relationship, Irrigation efficiency, *Pipes.
Identifiers: *Porous pipes.

Underground irrigation falls under the general category of drip irrigation used in the daily maintenance of an adequate section of the root zones of plants with moisture somewhere between dampness and saturation or field capacity throughout the growing season. This system enables the attainment of an optimized soil-water-plant relationship that is conducive to much better growth and substantially better yields, with less water applied. Evaporation is substantially eliminated, pipes are out of the way and water, along with fertilizer is applied where it does the most good. Water seeps from the underground pipe, and by capillary action and absorption spreads through the root system, maintaining a constant moisture level throughout the area of treatment. This invention relates to an irrigation porous pipe processed primarily of reclaimed material from rubber tires, ground to small granular size, mixed with a binder, mainly of polyethylene, with walling sized to withstand soil loading in an underground irrigation environment. The pipe is formed in the process through the extruder. Labyrinth passageways between rubber tire granular material and polyethylene binder mix, and through the binder mix, are also formed with the steam and gas foaming, or blowing, as the pipe is extrusion process formed. (Sinha-OEIS)
W77-09810

TRAVELING IRRIGATION SPRINKLER,

AG-Rain Inc., Havana, Ill. (Assignee).
F. V. Kruse, and D. O. Behrends.
U. S. Patent No. 4,003,519, 10 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 954, no 3, p 1099, January 18, 1977.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Irrigation efficiency, Application equipment, Water delivery(Applied).
Identifiers: *Traveling sprinkler.

A traveling irrigation sprinkler has a water-powered radial inflow turbine for driving a winch that pulls the sprinkler along a path of travel. Water is supplied to a sprinkler gun either directly from an inlet conduit, or indirectly by passing it through the turbine. A diverter valve proportions the direct and indirect flows and provides a means of controlling the travel speed of the sprinkler. A transmission interconnects the turbine and the winch and provides a means of controlling travel speed. The turbine includes a vaned runner and a scroll which surrounds the runner to deliver water at a uniform velocity to the periphery of the runner. (Sinha-OEIS)
W77-09811

REMOTE CONTROL FOR LARGE-AREA SPRINKLER SYSTEMS,

F. Hummel, Jr., and E. B. King.
U. S. Patent No. 4,004,612, 10 p, 11 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1525, January 25, 1977.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Sprinkler irrigation, *Remote control, Irrigation efficiency, Electrical design, Electrical equipment.

A remote control for a large-area sprinkler system operates the sprinklers in a sequential manner according to a specified program. The sprinklers are hydraulically operated and are controlled by a four-way latch valve whose piston, or core, will shift to either a sprinkler-open state or a sprinkler-closed state, the shifting being by energizing opposing solenoids. The electrical system to power the solenoids is a low voltage - low amperage control circuit permitting the use of small diameter wires to be extended from a central power supply

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

source to each sprinkler. A capacitor in the circuit adjacent to latch valves builds up a charge sufficient for one of the solenoids to be energized to shift the latch valve to either open or close the sprinkler. Each solenoid is connected in the circuit by a connective lead which includes an electronic gate such as an NPN transistor which will normally prevent a flow of current through the lead but which may receive a signal voltage, as at the base of the transistor to permit current to flow, as from the capacitor to the solenoid. A coded signal will permit any one of a large number to sprinklers to be selectively operated, and a computer can be used and programmed to control any selected operative sequence. (Sinha-OEIS) W77-09814

CROP TEMPERATURE MODIFICATION AND YIELD POTENTIAL IN A DWARF SPRING WHEAT.
International Maize and Wheat Improvement Centre, Londres (Mexico).
R. A. Fischer, and O. R. Maurer.
Crop Science, Vol 16, p 855-859, November-December 1976. 1 fig, 4 tab, 14 ref.

Descriptors: *Crop response, *Temperature control, *Plant growth, *Planting management, *Wheat, Crop production, Soil-water-plant relationships, Air temperature, On-site investigations, Dry farming, Irrigation effects, Growth chambers, Plant morphology, Mexico.

The effects of crop temperature modification were studied using a high yielding dwarf spring wheat (*Triticum aestivum* L. em Thell 'Yecora 70') grown under conditions of high fertility and irrigation in northwest Mexico during winter cropping cycles of 1972-73 and 1973-74. The influence of temperature was studied with respect to crop development, dry matter production and grain yield and its components. Portions of the crop were enclosed in transparent chambers ventilated with hot or cool air; chamber air temperatures averaged 1-2°C below or 2-7°C above outside temperatures. The irrigation interval was reduced by about 25% in these experiments to avoid significant soil water differences due to temperature modification. Crop development was retarded slightly by cooling and increased considerably by heating. Grain yield and total dry weight at maturity were reduced by higher temperatures at every stage after the first; effects on yield were greatest in the second and third periods (end of tillering to start of grain filling). Grains/spikelet was the component most affected by temperature (reduced by heating, increased by cooling), although effects were only in period 2. Heating in the fourth or grain-filling period sometimes reduced kernel weight. Under dryland conditions, high wheat grain number may not lead to high grain yield, and post-anthesis temperature, which is inevitably linked to humidity, evaporation and plant water status, may be more important. (Jahns-Arizona) W77-09939

EVALUATION OF AN EVAPOTRANSPIRATION MODEL FOR CORN,
Kansas State Univ., Manhattan. Dept. of Agronomy.
For primary bibliographic entry see Field 2D.
W77-09941

EFFECT OF INCREASING FOLIAGE REFLECTANCE ON THE CO₂ UPTAKE AND TRANSPIRATION RESISTANCE OF A GRAIN SORGHUM CROP.
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Agricultural Meteorology.
For primary bibliographic entry see Field 2D.
W77-09942

RELEASE OF CADMIUM FROM CLAYS AND PLANT UPTAKE OF CADMIUM FROM SOIL

AS AFFECTED BY POTASSIUM AND CALCIUM AMENDMENTS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2G.
W77-09962

SIMULATION OF PLANT GROWTH BY HUMIC SUBSTANCES,
Vermont Univ., Burlington. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 2I.
W77-09963

NITROGEN, PHOSPHORUS, AND POTASSIUM UTILIZATION IN THE PLANT-SOIL SYSTEM: AN ANALYTICAL MODEL,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 2I.
W77-09964

INFLUENCE OF LONG TERM TILLAGE, CROP ROTATION, AND SOIL TYPE COMBINATIONS ON CORN YIELD,
Ohio Agricultural Research and Development Center, Wooster. Dept. of Agronomy and Agricultural Engineering.
D. M. Van Doren, Jr., G. B. Triplett, Jr., and J. E. Henry.
Soil Science Society of America Journal, Vol 40, No 1, p 100-105, January-February 1976. 5 tab, 12 ref.

Descriptors: *Till, *Crop production, Crop response, Corn(Field), Crops, Soybeans, Ohio, Soils, *Cultivation, *Rotations.
Identifiers: *Tillage practices, Crop rotation, Corn yield.

Studies to compare the relative ability of a wide range of tillage and crop rotation combinations (3 multiplied by 3 factorial) to sustain corn production on several soils typical of Ohio were initiated in 1962. Soils were a well-drained Wooster silt loam, an imperfectly drained Crosby silt loam, a very poorly drained Hoytville silty clay loam, and a very poorly drained Toledo clay. Tillage treatments were no-tillage; plow and then plant; and plow, disk, and plant. Rotations were continuous corn, corn-soybeans, and corn-oats with each crop appearing each year in each rotation. Results are reported only for plots having equal plant density within a site-year combination, and adequate weed control. Corn yields were remarkably insensitive to tillage. The two plowed treatments had equal yield for virtually all years at each site within the same rotation. (Skogerboe-Colorado State) W77-09969

UPTAKE OF CADMIUM BY SOYBEANS AS INFLUENCED BY SOIL CATION EXCHANGE CAPACITY, PH AND AVAILABLE PHOSPHORUS,
Argonne National Lab., Ill.
For primary bibliographic entry see Field 2G.
W77-09977

SCIENTIFIC BASES OF A SYSTEM FOR AVERTING UNFAVORABLE CONSEQUENCES OF STEPPE SOIL IRRIGATION, (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 2G.
W77-10021

IRRIGATION REQUIREMENTS OF MATURE PEACH TREES UNDER MICROJETS (BESPROEINGSBEHOEFES VAN VOLWASSE PERSKEBOME ONDER MIKROSPUIT),
Soils and Irrigation Research Inst., Pretoria (South Africa).
J. Piaget, J. Pienaar, and J. Van Zyl.
The Deciduous Fruit Grower, Vol 26, No 4, p 144-146, 1976. Illus, 1 tab.

Descriptors: *Irrigation efficiency, Deciduous trees, Nutrient requirements, Fertilizers, Tensiometers, *Peaches, Fruit crops, Jets, Africa.
Identifiers: South Africa, Stellenbosch.

An experiment in controlled irrigation was carried out during the 1975/76 season in a block of four hectares of 12-year-old Dr Black clingstone peaches, planted 6.1x6.1 metres, on a soil of the Hutton farm situated on the upper slopes of the Devon Valley near Stellenbosch. The crop of 25 tons per hectare of good quality peaches obtained from the orchard was produced with an application of 245 mm/ha. Each tree was irrigated with 9 142 litres of water. It is recommended that 20 irrigations, each of 9 hours duration, should be assured in order to calculate the minimum yearly irrigation requirement of this orchard. Such an irrigation program would then need 306 mm/ha. This figure represents approximately 65% of the quantity of water at present estimated to be necessary for irrigation with conventional sprinkler systems. (So African Water Info Center) W77-10079

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE TUGELA-VAAL STATE WATER SCHEME AS A BILHARZIA RISK (DIE TUGELA-VAAL-STAATSWATERSKEMA AS 'N BILHARZIARISIKO),
South African Medical Research Council, Potchefstroom.
For primary bibliographic entry see Field 5G.
W77-09690

A LABORATORY MODEL TO INVESTIGATE THE SOIL MOISTURE CONDITIONS ON A DRAINING SLOPE,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W77-09712

DESIGN AND OPERATION OF RAIN SPILLWAYS AND RAIN OVERFLOW CATCHMENT (ENTWURF UND BETRIEB VON REGENÜBERLAUFEN (RU) UND REGENÜBERLAUF-BECKEN (RUB),
For primary bibliographic entry see Field 8B.
W77-09822

CHICAGO PLAN DESIGNED FOR POLLUTION AND FLOOD CONTROL.
Water and Sewage Works, Vol. 124, No. 5, p 50-51, May, 1977.

Descriptors: *Tunnels, *Reservoirs, *Pollution abatement, *Flood control, Storm water, Water purification, Storage, Urban runoff, Conveyance structures, Tunneling, Costs, Illinois.
Identifiers: Chicago(IL).

Construction has begun on a Chicago, Illinois, tunnel and reservoir plan for pollution and flood control. Phase one comprises storm water and sewage conveyance, storage, and purification. Ninety-one miles of 9 to 35-foot diameter tunnels at 150 to 300 feet below ground will be drilled through dolomitic rock. Phase two will provide flood control. It will involve 21.2 miles of 30 and 35-foot diameter tunnels, and storage reservoirs with a volume of 127,000 acre-feet of runoff water from a tributary area of 363.8 square miles. Total costs for the project were estimated as \$1,912.4 million. The present interceptors are subject to runoff volumes 15 to 30 times that of design capacities. The

Control Of Water On The Surface—Group 4A

planned expansions will allow storage in the tunnel system and three open-pit quarries. Combined sanitary/storm water flows would be pumped from storage and treated at the present facilities during dry weather to prevent flooding of low-lying areas and the discharge of untreated sewage into waterways. Drop shafts will interrupt sewer flow for diversion into the tunnels. Portions of the system which have been completed were described. (Collins-FIRL)
W77-09838

OPTIMAL OPERATION OF FLOOD CONTROL SYSTEMS, (FINAL REPORT; V.II), Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering.
C.-J. Feng, and T. L. Morin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 454. Price codes: A10 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 122, March 1977. 194 p, 40 fig, 28 tab, 91 ref. OWRP A-079-III(2).

Descriptors: *Flood control, *Dynamic programming, *Reservoir operation, *Stochastic processes, Methodology, *Multiple-purpose reservoirs, Management, Model studies, *Illinois, Markov processes, Flood damage, Flood peak, Optimization.
Identifiers: *Optimal operation(Reservoirs).

The management and control of multiple-reservoir flood control systems is studied. The objective is to devise operating policies which minimize flood damages as determined by the flood peaks. Methodologies are presented that employ dynamic programming and stochastic dynamic programming for the optimal operation of multiple-reservoir flood control systems with deterministic and stochastic inflows, respectively. The methodologies are applied to a number of real-world problems involving river basins in Illinois and elsewhere. The effects of parametrically varying a number of the input parameters were studied. A Markov renewal flood synthesis model and a methodology for determining the optimal capacity of a new flood control reservoir are also presented. (See also W77-10263)
W77-09927

THE SHORE AND THE WATER-THE LOCALIZATION OF DAMAGE AND THE REGULATION OF FISH MANAGEMENT IN CONTROLLED LAKES, (IN SWEDISH), T. Lindstrom.
Fauna Flora (Stockh) 70(2), p 56-59, 1975.

Descriptors: *Fish management, Lakes, Regulation, Lake shores, Plankton, Water level fluctuations, Fish diets, Energy budget, Aquatic life, Productivity.

In lakes used as reservoirs there is often much damage to plankton and other plant and animal life due to fluctuations in water level. Productivity of such lakes may be increased by the addition of plant material but it will probably be cheaper to use artificial fish food. There is a serious lake of data on the whole energy budget in these lakes.—Copyright 1976, Biological Abstracts, Inc.
W77-09935

WATER SUPPLY FROM SHELBYVILLE AND CARLYLE LAKES AND THEIR OPTIMAL JOINT OPERATION, Illinois State Water Survey, Urbana. Hydrology Section.
K. P. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 444. Price codes: A05 in paper copy, A01 in microfiche. ISWS Report of Investigation 84, 1977. 76 p, 18 fig, 39 tab, 21 ref.

Descriptors: *Multiple-purpose projects, *Reservoir operation, *Illinois, *Computer models, *Operations research, Lakes, Model studies, Computer programs, Reservoirs, Water supply, Data processing, Flood control, Navigation, Water policy, Evaporation, Precipitation(Atmospheric), Systems analysis, Hydrologic systems, Simulation analysis, Statistical methods, Synthetic hydrology, Streamflow, Optimization, Recreation.
Identifiers: *Carlyle Lake(III), *Shelbyville Lake(III).

The U. S. Army Corps of Engineers, St. Louis District, has been regulating Lake Shelbyville and Carlyle Lake on the Kaskaskia River in Illinois for recreation and flood control since completion of the dams in 1969 and 1967, respectively. The navigation channel below Fayetteville to the Mississippi River has been completed. The demand for water supply by the industries and towns in the Kaskaskia River basin below Shelbyville and Carlyle has been increasing during the last 2 years. These lakes will soon have to be regulated for the multiple purposes for which they were built, that is, recreation, flood control, water supply, and navigation. The state of Illinois has a reserve storage capacity of 25,000 ac-ft in Shelbyville and 33,000 ac-ft in Carlyle for meeting future water supply requirements. Analyses of the weekly flows, precipitation on and evaporation from the lakes, and navigation flow requirements for the 24-year (1942-1965) historical period and a 499-year period of synthetic data indicated that under the terms of the agreement between federal and state governments, 100 cubic feet per second (cfs) or 65 million gallons per day (mgd) water supply withdrawal can be made from the system with an average deficit frequency of 1 in 50 years. Optimal operating policies for the joint regulation of Shelbyville and Carlyle lakes for various levels of navigation and water supply requirements have been derived from more than 10,000 system simulation runs made with historical and synthetic data. The optimal operation rules indicate a rise in rule levels with increase in navigation and water supply requirements. The joint regulation can be updated with development of navigation and water supply to obtain the maximum benefits. When state and federal storages are considered separate and distinct, and the total storage is regulated in the best interest of all purposes as done in deriving the optimal operating rules, the minimum lake levels reached are higher than the dead storage pool elevations even with 200 cfs (130 mgd) water supply withdrawal and full navigation. (Humphreys-ISWS)
W77-09943

LAKE DARDANELLE, ARKANSAS RIVER; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-09988

WATER-RESOURCES APPRAISAL OF THE CARSON RIVER BASIN, WESTERN NEVADA, Geological Survey, Carson City, Nev. Water Resources Div.
P. A. Glancy, and T. L. Katzer.
Nevada Division of Water Resources, Carson City, Water Resources—Reconnaissance Series Report 59, 1976. 126 p, 6 fig, 1 plate, 40 tab, 90 ref.

Descriptors: *Water resources, *Water supply, *Water utilization, *Water demand, *Water quality, Nevada, Urbanization, Water pollution sources, Sewage disposal, Available water, Surface waters, Groundwater, Aquifer characteristics, Hydrogeology, Hydrologic data, Evaluation.
Identifiers: *Carson River basin(Western Nev).

Water-resource development in Nevada has increased substantially in recent years. Current in-

creases relate strongly to urban and suburban population growth. The growing interest in ground-water development has created a substantial demand for information on ground-water resources throughout the State. The study area lies at the western edge of the Great Basin, and encompasses six major hydrographic areas and one hydrographic subarea, but excludes most of the Carson River drainage in California. Five of the hydrographic areas are part of the Carson River drainage basin; the sixth, White Plains, is the terminus of the Humboldt River basin and connects that drainage to Carson Desert. Packard Valley is tributary to Carson Desert, but not directly to Carson River. In addition to the established hydrologic-investigation programs this study evaluates (1) present trends of water use, compared to traditional historical uses, (2) inter- and intra-basin sewage disposal problems, (3) problems related to water quality, (4) geohydrologic hazards. (Woodard-USGS)
W77-09992

COMPUTATION OF UNSTEADY FLOWS IN RIVERS AND ESTUARIES BY THE METHOD OF CHARACTERISTICS, Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-09993

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1976 WATER YEAR, Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09997

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 1. OHIO RIVER BASIN, Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10000

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 2. ST. LAWRENCE RIVER BASIN, Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10001

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1975, Geological Survey, Cheyenne, Wyo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10002

COMPUTATION OF RECORDS OF STREAM-FLOW AT CONTROL STRUCTURES, Geological Survey, Bay Saint Louis, Miss. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-10003

APPLICATION OF THE U.S. GEOLOGICAL SURVEY RAINFALL RUNOFF SIMULATION MODEL TO IMPROVE FLOOD-FREQUENCY ESTIMATES ON SMALL TENNESSEE STREAMS, Geological Survey, Nashville, Tenn. Water Resources Div.
For primary bibliographic entry see Field 2A.
W77-10004

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

THE GREAT DISMAL SWAMP: MANAGEMENT OF A HYDROLOGIC RESOURCE WITH THE AID OF REMOTE SENSING.
Geological Survey, Reston, Va. Water Resources Div.; and Great Dismal Swamp National Wildlife Refuge, Suffolk, Va.; and National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 2H.
W77-10007

VARIATION OF WIDTH AND DISCHARGE FOR NATURAL HIGH-GRADIENT STREAM CHANNELS.
Geological Survey, Lawrence, Kans. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-10009

WATER RESOURCES OF THE UMATILLA INDIAN RESERVATION, OREGON.
Geological Survey, Portland, Ore. Water Resources Div.
J. B. Gonthier, and D. D. Harris.
Water-Resources Investigations 77-3, 1977. 112 p, 23 fig, 1 plate, 14 tab, 36 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Indian reservations, *Oregon, *Streamflow, Flow rates, Aquifer characteristics, Water wells, Water yield, Water analysis, Chemical analysis, Hydrologic data, Irrigation, Water supply.
Identifiers: *Umatilla Indian Reservation(Ore), Umatilla River basin, Umatilla County.

Water resources of the Umatilla Indian Reservation are poorly distributed in space and time. Only the Umatilla River and one of its principal tributaries, Meachum Creek, have significant perennial flows. Surface-water outflow from the reservation averages about 600 cubic feet per second, the total stream inflow is about 540 cubic feet per second. Runoff of the principal streams is largely from snowmelt in the Blue Mountains and is highly variable. The principal aquifers are the Columbia River Basalt Group and Quaternary alluvium. The basalt underlies the entire reservation to a depth of a few thousand feet and most wells tap this source. Yields of wells in the basalt range from less than 1 to more than 1,200 gallons per minute. Quaternary alluvium averages about 12 feet thick in the Umatilla River valley, where it has the greatest extent. It is generally thinner and of smaller extent in other valleys. Surface water is soft and generally contains less than 120 mg/liter of dissolved solids. Ground water is generally moderately hard or hard, and dissolved solids range between 200 and about 250 mg/liter. The water is suitable for most uses. (Woodard-USGS)
W77-10011

1976 WATER-QUALITY DATA IN BEAR CREEK BASIN, MEDFORD, OREGON.
Geological Survey, Portland, Ore. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10015

NORTH FORK LAKE SPILLWAY SAN GABRIEL RIVER, TEXAS; HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10017

OLD RIVER EXISTING LOW-SILL CONTROL STRUCTURE, LOUISIANA; HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10018

CONVEX CHUTES IN CONVERGING SUPER-CRITICAL FLOW.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10020

DIVIDE CUT DRAINAGE STRUCTURES TENNESSEE-TOMBIGBEE WATERWAY MISSISSIPPI AND ALABAMA; HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10046

ENTRANCE TO UPSTREAM APPROACH CANAL, GAINESVILLE LOCK, TOMBIGBEE RIVER, MISSISSIPPI AND ALABAMA; HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10047

BUTOXYETHANOL ESTER OF 2,4-D FOR CONTROL OF EURASIAN WATER MILFOIL.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
E. O. Gangstad, F. Fish, R. A. Stanley, T. Duke, and C. A. Rodgers.
Available from the National Technical Information Service as AD-A024 105. Price codes: A07 in paper copy, A01 in microfiche. Aquatic Plant Control Program, Technical Report 12, March 1976. 139 p, 18 fig, 25 tab, 42 ref.

Descriptors: *Aquatic weed control, *Herbicides, *2,4-D, North Carolina, *Tennessee Valley Authority, Environmental effects, *Plant growth, *Pesticide residues, Biota, Application methods, Solubility, Tennessee, Fish, *Rooted aquatic plants.
Identifiers: *Myriophyllum spicatum water milfoil, 2,4-D registration.

A report is made on activities which constitute the third phase of a program for herbicidal control of *Myriophyllum spicatum* L., the growth of which has become serious in Tennessee Valley Authority reservoirs and in other locations. The first two phases of the program included defining a suitable herbicide-2,4-D-and a method of application, along with the development of toxicological and residue data. The present phase consists of developing a suitable level and a program of application. The report includes: (1) a summary of the Army Corps of Engineers Aquatic Plant Control Research Program; (2) a description of the proposed registration label, areas of intended use and nomenclature of physical and chemical properties of the herbicide; (3) an environmental impact statement for control of the Eurasian Water Milfoil in certain North Carolina waters; (4) an overview of the plant in the Tennessee Valley; (5) a description of the effects of 2,4-D on estuarine organisms; (6) a discussion of 2,4-D butoxyethanol ester uptake distribution and elimination in organs of rainbow trout, channel catfish and bluegills; (7) changes in the structure and metabolism in a Eurasian Water Milfoil community following 2,4-D treatment. (Harris-Wisconsin)
W77-10057

DESTRUCTION OF VEGETATION ON DAMS OF THE GORKY HYDROELECTRIC POWER PLANT WITH HERBICIDES.
A. A. Anisimov, T. A. Bulatova, and V. A. Valutina.
ORNL Technical Translation 2931. 5 p. Translated from Uchenye Zapiski Gor'kovskogo Gosudarstvennogo Universiteta, No. 98, p 110-114, 1970. 4 ref. (In Russian).

Descriptors: *Fouling, *Herbicides, *Aquatic weed control, Aquatic weeds, Vegetation effects, Soil filters, Foreign research.
Identifiers: *Gorky Hydroelectric Power-plant(USSR), Filter clogging.

Results are described of tests made with various dilutions of a number of herbicides, selected to evaluate their applicability to eradicate grassy and shrubby plant growth on the gravel filters of the earth dam of the hydroelectric station at Gorky, USSR. Because of the 7 km length of the dam, manual rinsing of the filters was judged impractical and attempts to destroy the growth by burning did not give good results. The testing was carried out in stages from 1966-68. During the first year, the action of four herbicide applications was tested: (1) 6% suspension of simazine; (2) 18% suspension of simazine; 10% suspension of diuron; (3) 8% dalapon mixed with 0.6% butyl ester of 2,4-D. In 1967, various strengths of simazine and diuron were again tested, along with atrazine and sodium trichloroacetate with borax. Finally, in 1968, simazine was tested again in comparison with 'radocore', a chloroaminotriazine base herbicide. Based on recommendations of the study, the manager of the Gorky electric power station in 1968 treated the slopes of the dam for 4 km with 3% radocore, using a GAN-15 sprayer, for a 3-week period. The gravel covering of the filters remained free of plants until the end of the vegetation period. (Harris-Wisconsin)
W77-10059

PROPOSED PIPELINE SYSTEM WILL LINK WATER SCHEMES DWA'S R24 MILLION BALANCING ACT.
For primary bibliographic entry see Field 8B.
W77-10069

STABILIZATION OF SAND DUNES IN THE WEST SAHARA.
Department of Forestry, Pretoria (South Africa).
G. Alvarez de Benito, and P. J. le Roux.
South African Forestry Journal, No 97, p 36-43, June, 1976. 11 illus, 6 tab.

Descriptors: Desert plants, Dunes, *Dune sands, *Stabilization, Africa, Arid climates, Deserts.
Identifiers: Spanish Sahara, Launea arborescens, Zygophyllum waterlotti, *Sahara desert.

The methods employed in stabilizing dune sand in the Spanish Sahara, to protect a conveyor belt, are described, as well as the supply, storage and use of the fuel oil and the erection of fences used in stabilizing the sand. Mention is made of the indigenous plants occurring in this area and of those plants which established themselves naturally on the oil-sprayed dunes. A brief description is given of the climatic conditions prevailing in the area and how plants probably survive in such an area with an annual rainfall of 43 mm. (So African Water Info Ctr)
W77-10074

SMALL CATCHMENT FLOOD MODELLING.
South African Dept. of Water Affairs, Pretoria. Div. of Hydrology.
For primary bibliographic entry see Field 2E.
W77-10083

4B. Groundwater Management

AN ELECTRIC ANALOG AND DIGITAL COMPUTER MODEL OF THE CHIPUXET GROUND WATER AQUIFER, KINGSTON, RHODE ISLAND.
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W77-09637

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,

Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 5B.
W77-09915

CARBON ISOTOPIC STUDY OF THE FATE OF LANDFILL LEACHATE IN GROUNDWATER,

Indiana Univ., Bloomington. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W77-09917

GROUNDWATER POLLUTION HAZARD NEAR SANITARY LANDFILLS ON THE GLACIATED PLAINS, NORTH DAKOTA - A STUDY OF THE LANGDON, NORTH DAKOTA SANITARY LANDFILL,

Geological Survey, Grand Forks, N. Dak.
For primary bibliographic entry see Field 5B.
W77-09925

GEOCHEMICAL CONTROLS ON TRACE ELEMENT CONCENTRATIONS IN NATURAL WATERS OF A PROPOSED COAL ASH LANDFILL SITE,

Kansas State Univ., Manhattan. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-09928

STATISTICAL ANALYSIS OF THE IMPACT OF GROUND WATER PUMPAGE ON LOW-FLOW HYDROLOGY,

Wisconsin Univ., Oshkosh. Dept. of Geology.
C. W. Fetter, Jr.
Water Resources Bulletin, Vol. 13, No. 2, p 309-323, April 1977. 7 fig, 1 tab, 8 ref.

Descriptors: *Pumping, *Groundwater, *Interbasin transfers, *Low flow, *Diversion, *Wisconsin, Hydrology, Water table, Withdrawal, Forecasting, Regression analysis.
Identifiers: *Yahara River(Wisc), Low-flow hydrology.

Heavy groundwater pumpage in the Yahara River basin has resulted in lowering of the water table. As a means of preserving surface water quality, treated wastewater was diverted from the upper basin in 1958. The two mentioned factors have acted together to produce a depletion in Yahara River streamflow of more than 50% during periods of low flow. Regression analyses showed that the annual 7-day and 60-day low flows have a statistically significant correlation with mean annual flow. Using predictions of future mean annual discharge of the river with increasing interbasin transfers, it was shown that by 1990 there is a significant probability that in some years the 60-day low flow in the river will be zero. The drainage area of the upper basin is 328 sq mi above McFarland, Wisconsin. (Singh-ISWS)
W77-09952

THE COCKFIELD AQUIFER IN MISSISSIPPI,

Geological Survey, Jackson, Miss. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09991

WATER-RESOURCES APPRAISAL OF THE CARSON RIVER BASIN, WESTERN NEVADA,

Geological Survey, Carson City, Nev. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-09992

MODELING CHLORIDE MOVEMENT IN THE ALLUVIAL AQUIFER AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,

Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 5B.

W77-09994

GROUND-WATER RESOURCES OF THE LEXINGTON, KENTUCKY, AREA,

Geological Survey, Louisville, Ky. Water Resources Div.
R. J. Faust.
Water-Resources Investigations 76-113 (open-file report), February 1977. 24 p, 6 fig, 3 plates, 5 tab, 18 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, Water utilization, Water pollution sources, Runoff, Bacteria, Limestones, Infiltration, Karst, *Kentucky.
Identifiers: *Lexington area(KY).

Ground water in the Lexington, Kentucky, area occurs in Ordovician Limestones in which cavity development is generally limited to about 100 feet below land surface. Some wells produce about 300 gallons per minute in some of the large stream valleys, about 50 gallons per minute in the rolling upland and small stream valleys, and about 5 gallons per minute on hilltops and steep slopes. Many wells throughout the area do not furnish adequate water for domestic supplies because no significant water-bearing openings are penetrated during drilling. Ground-water use is limited mostly to domestic and stock supplies and a few small public supplies. Ground water is generally a calcium bicarbonate type and in places contains sodium chloride and (or) hydrogen sulfide. Bacterial pollution of ground water is widespread because of direct recharge of polluted runoff and streamflow to cavernous limestones. (Woodard-USGS)
W77-09996

SELECTED WATER-LEVEL RECORDS FOR WESTERN OKLAHOMA, 1975-1976,

Geological Survey, Oklahoma City, Okla. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09998

GROUND-WATER LEVELS IN OBSERVATION WELLS IN OKLAHOMA, 1975,

Geological Survey, Oklahoma City, Okla. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09999

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975-VOLUME 1. OHIO RIVER BASIN,

Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10000

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975-VOLUME 2. ST. LAWRENCE RIVER BASIN,

Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10001

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1975,

Geological Survey, Cheyenne, Wyo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10002

ANNUAL WATER-RESOURCES REVIEW WHITE SANDS MISSILE RANGE, 1976 - A BASIC-DATA REPORT,

Geological Survey, Albuquerque, N. Mex. Water Resources Div.
R. R. Cruz.

Open-file report 77-330, April 1977. 27 p, 7 fig, 4 tab, 2 ref.

Descriptors: *Hydrologic data, *Water wells, *Water level fluctuations, *Water quality, *Water supply, Military reservations, Hydrogeology, Observation wells, Test wells, Chemical analysis, Water yield, Pumping, Basic data collections, *New Mexico.
Identifiers: *White Sands Missile Range(N Mex).

Information is presented on the water resources of the White Sands Missile Range, N. Mex., that was collected during the period December 1975 to December 1976 by personnel of the U.S. Geological Survey, Water Resources Division. Data on ground-water pumpage and resulting water-level fluctuation, chemical quality and precipitation, and miscellaneous items of interest are summarized. Water-level observations were made in 63 borehole, supply, test, and observation wells on the Range. Water samples were collected and analyzed for chemical quality from 8 test wells. (Woodard-USGS)
W77-10005

A METHOD OF ESTIMATING PARAMETERS AND ASSESSING RELIABILITY FOR MODELS OF STEADY STATE GROUNDWATER FLOW 1. THEORY AND NUMERICAL PROPERTIES,

Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-10008

WATER RESOURCES OF THE UMATILLA INDIAN RESERVATION, OREGON,

Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-10011

GEOHYDROLOGY OF MUSCATINE ISLAND, MUSCATINE COUNTY, IOWA,

Geological Survey, Iowa City, Iowa. Water Resources Div.
R. E. Hansen, and W. L. Steinhilber.
Iowa Geological Survey, Iowa City Water-Supply Bulletin No 11, Published by State of Iowa, 1977. 60 p, 28 fig, 4 plates, 6 tab, 9 ref.

Descriptors: *Hydrogeology, *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, Flood plains, *Mississippi River basin, *Iowa, Water supply, Water utilization, Water level fluctuations, Groundwater movement, Groundwater recharge.
Identifiers: *Muscatine County(Iowa).

Muscatine Island is a wide segment of the west bank of the Mississippi River flood plain that covers about 50 square miles in Muscatine and Louisa Counties; the project area encompasses the 30 square miles in Muscatine County, Iowa. The aquifer consists principally of sand and gravel, interbedded with lenses of silt and clay. Its saturated thickness ranges from about 40 to 140 feet. The transmissivity and storage coefficients of the aquifer range from about 20,000 sq ft/day and 0.15, respectively, in the western part of the island to about 39,500 sq ft/day and 0.24 in the eastern part. The amount of water stored in the aquifer, under normal conditions, is about 100 billion gallons. Discharge from the aquifer is principally by pumpage, which has increased from about 1 mgd in 1906 to about 37 mgd in 1970. About 2.5 mgd is normally lost to seepage and evapotranspiration along a 9-mile reach of Muscatine Slough in Muscatine County. About 0.9 mgd is discharged by evaporation from gravel pits. The chemical constituents of water from the aquifer are generally within the recommended limits established by the U.S. Public Health Service for drinking water. (Woodard-USGS)
W77-10012

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

FLUCTUATIONS OF GROUND-WATER LEVELS IN LEE COUNTY, FLORIDA, IN 1975 WATER YEAR.
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-10014

ELECTRICAL WATER PROSPECTING.
Council for Scientific and Industrial Research, Pretoria (South Africa). Geophysics Div.
For primary bibliographic entry see Field 2F.
W77-10100

4C. Effects On Water Of Man's Non-Water Activities

LOGGING ROADS AND PROTECTION OF WATER QUALITY.
Arnold, Arnold and Associates, Seattle, Wash.; and Dames and Moore, Seattle, Wash.
For primary bibliographic entry see Field 5G.
W77-09725

WATER TRANSPORT OF WOOD (IN CANADA): THE CURRENT SITUATION.
Environmental Protection Service, Regina (Saskatchewan). Water Pollution Control Branch.
For primary bibliographic entry see Field 5C.
W77-09755

EFFECTS OF LOG HANDLING AND STORAGE ON WATER QUALITY.
Corvallis Environmental Research Lab., Oreg.
For primary bibliographic entry see Field 5C.
W77-09760

THE FUNCTIONAL AND AESTHETIC USES OF TWO CACHE VALLEY, UTAH, CANALS.
Utah State Univ., Logan. Dept. of Landscape Architecture and Environmental Planning.
For primary bibliographic entry see Field 6B.
W77-09796

THE EFFECT OF STRIP-CUTTING ON STREAM TEMPERATURES IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE.
Cornell Univ., Ithaca, N.Y. Section of Ecology and Systematics.
T. M. Burton, and G. E. Likens.
Bioscience. Vol. 23, No. 7, p 433-435 1973.

Descriptors: *Clear cutting, *Forest management, Streams, Temperature, Aquatic life, Eutrophication, Light, New Hampshire.
Identifiers: Hubbard Brook (New Hampshire), *Strip cutting.

A series of observations were made in 1971 to determine the effect of forest canopy removal on the temperature of a stream passing through the cut strips in a New Hampshire forest. Temperature measurements were made with a glass Hg thermometer. Stream temperatures prior to cutting were fairly constant over the 625 m study section; after cutting, fluctuations of 4-5C were apparent in passing from cut to uncut zones. Cut sections were warmer in the daytime on sunny days and cooler at night than the uncut sections. Possible effects of the altered conditions on aquatic communities (vertebrates, invertebrates) are considered; the only observation was an algal bloom thought to be the result of increased light more than temperature.—Copyright 1974, Biological Abstracts, Inc.
W77-09807

VEGETATION MANIPULATION--A CASE STUDY OF THE PINYON-JUNIPER TYPE.
Utah State Univ., Logan. Coll. of Natural Resources.
G. F. Gifford.
In: Watershed Management on Range and Forest Lands, Proceedings of the Fifth Workshop of the U.S./Australia Rangelands Panel, Boise, Idaho, p 141-148, March 1976. 2 tab, 41 ref.

Descriptors: *Vegetation establishment, *Range management, *Vegetation effects, *Pinyon pine trees, *Juniper trees, *Land clearing, Interception, Infiltration, Runoff, Soil-water-plant relationships, Soil moisture, Sediment discharge, Sediments, Erosion control.
Identifiers: *Vegetation manipulation.

Principles and effects of converting pinyon-juniper woodland to a grass or grass-shrub vegetation are presented. Of the techniques used for clearing trees, chaining is the most common. Grass and browse seed are usually drilled or broadcast-seeded, depending on the debris disposal methods. Observed watershed impacts are outlined for various techniques of tree removal. Studies are reported of interception losses and infiltration on pinyon-juniper rangelands under various site factors, grazing and burning. Infiltration rates are only slightly decreased on chained sites; grazing impact is cumulative, and burning depresses the rates. Vegetation manipulation appears to have little effect on soil moisture patterns or runoff; the greatest runoff will occur on sites chained with debris windrowed. Sediment discharges do not usually increase; minimum sediment yields (equal to those from undisturbed woodland) occur when surface soil disturbance is minimized or where debris is left in place. Increased forage is likely from the pinyon-juniper type. Impacts on wildlife and economic considerations are also discussed. (Jahns-Arizona)
W77-09959

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 17-4, NUMERICAL MODEL FEASIBILITY STUDY.
Army Engineer Waterway Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10048

IMPACT OF ECONOMIC RISKS ON BOX CULTIVATED DESIGNS--AN APPLICATION TO 22 VIRGINIA SITES.
Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 8B.
W77-10067

4D. Watershed Protection

RATES OF TRANSPORT OF TOTAL PHOSPHORUS AND TOTAL NITROGEN IN MACKENZIE AND YUKON RIVER WATERSHEDS, N.W.T. AND Y.T., CANADA.
For primary bibliographic entry see Field 5C.
W77-09617

LOGGING ROADS AND PROTECTION OF WATER QUALITY.
Arnold, Arnold and Associates, Seattle, Wash.; and Dames and Moore, Seattle, Wash.
For primary bibliographic entry see Field 5G.
W77-09725

FOREST HARVEST, RESIDUE TREATMENT, REFORESTATION, AND PROTECTION OF WATER QUALITY.
Montgomery (James M.), Inc., Boise, Idaho.
For primary bibliographic entry see Field 5G.
W77-09756

MATting FOR THE PREVENTION OF HYDRAULIC EROSION.
W. Muhring, and E. Gossling.
U.S. Patent No. 4,002,034, 8 p, 9 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 603, January 11, 1977.

Descriptors: *Patents, *Erosion, *Erosion control, Bank protection, Bank erosion, Beach erosion.
Identifiers: *Fiber matting (Erosion control).

Hydraulic erosion is prevented through the use of matting having a number of layers of felt with different pore spaces or pore volumes and fibers of different thicknesses, and a woven backing of synthetic fiber. The matting is anchored to the ground surface of an embankment adjacent a body of water for preventing erosion due to the action of the water. This invention provides a matting so constructed that it does not become blocked by fine particles, that a stable connection between the matting and the ground is ensured, and that after a certain time stable mechanical and hydraulic conditions of the fiber matting and bank are established. The upper side, which faces towards the water, is provided with a layer in which the resistance to the flow of fluid through it is substantially less in the direction from ground to water than in the opposite direction. The uppermost layer of the matting consists of a flexible sheet having holes which can be closed by means of flaps arranged to cover the holes. The flaps are pressed against the edges of the holes when the water flows from the upper side of the matting toward the ground and are lifted from the holes by a flow in the opposite direction, i.e., from the ground side. The flexible cover sheet can be fabricated in two superposed layers, with the upper one being provided with flaps and the lower one with holes. (Sinha-OEIS)
W77-09798

VEGETATION MANIPULATION--A CASE STUDY OF THE PINYON-JUNIPER TYPE.
Utah State Univ., Logan. Coll. of Natural Resources.
For primary bibliographic entry see Field 4C.
W77-09959

GRASSING ROADS AND ERODED AREAS IN THE DRAKENSBURG.
Natal Univ., Pietermaritzburg (South Africa). Dept. of Forestry.
H. Haigh.
South African Forestry Journal, No 97, p 63-66, June 1976. 8 fig, 1 ref.

Descriptors: *Soil erosion, Grasses, Fertilizers, *Erosion control, Africa.
Identifiers: *South Africa, *Drakensburg, Cynodon dactylon, Eragrostis curvula, Spartium junceum.

Aspects of erosion control are described. Using fertilizer, good success has been achieved in grassing three types of exposed soil. Bare road surfaces planted to Cynodon dactylon were soon covered with a mat of runners and the strip between the wheel tracks has been colonised by local grasses. Road cuttings and vertical erosion faces were sloped to 45 deg and successfully sown to Eragrostis curvula. Lines of broom (Spartium junceum) were successfully sown in the steep sides of deep gulleys, but mechanical sloping of the sides to a more gentle slope and seeding to Eragrostis is recommended. (So African Water Info Ctr)
W77-10075

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EVALUATION OF PROCESS DESIGN PARAMETERS FOR PHOSPHORUS REMOVAL FROM DOMESTIC WASTE WATERS BY CHEMICAL CLARIFICATION, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 5D. W77-09602

A METHODOLOGY FOR COMPARATIVE EVALUATION OF WATER QUALITY INDICES, Worcester Polytechnic Inst., Washington, D. C. Project Center. W. E. Booth, P. C. Carubia, and F. C. Lutz. Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 572. Price codes: A08 in paper copy, A01 in microfiche. Report to Council on Environmental Quality, Washington, D. C. 1976. 161 p. 36 fig., 15 tab., 9 ref., 5 append.

Descriptors: *Water quality, *Evaluation, *Methodology, *Measurements, *Analytical techniques, *Physicochemical properties, *Pollutants, *Assessments, *Theoretical analysis, *Indicators, *Bioindicators, *Pollutant identification. Identifiers: *Water quality indices.

The relative usefulness of water quality assessment indices is examined by use of a methodology that compares and evaluates their performance characteristics. The method so devised demonstrates the evaluation of two indices by identifying their assumptions and limitations. Evaluation of the National Sanitation Foundation (NSaF) index shows that it is only suitable to assess the overall water quality as characterized by nine physicochemical parameters. It is somewhat insensitive to pollution problems exhibited in only one of the parameter's values. Since the parameters, quality ratings, and weights that are used are fixed, they cannot vary to account for the ultimate use of the index, data availability, new discoveries, or conditions associated with different geographic locations. Applications of the NSaF index are extremely limited when attempting to identify or analyze specific pollution problems as they may affect a water use. Conversely, the Harkins' index is best used when assessing trends in a specific pollution problem area. The index has no set parameter requirements and is therefore very flexible in application since only those parameters of interest to the user need be included in the computations. (Auen-Wisconsin). W77-09632

A QUANTITATIVE METHOD FOR TOXAPHENE BY GC-CI-MS SPECIFIC ION MONITORING, Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch. A. D. Thruston. Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 931. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-76-010, March 1976. 28 p. 10 fig., 9 ref., 1 append. 1BD612.

Descriptors: *Pollutant identification, *Analytical techniques, *Pesticides, *Chlorinated hydrocarbon, *Measurement, *Gas chromatography, *Mass spectrometry, *Pesticide residues, *Monitoring. Identifiers: *Toxaphene, Chemical ionization.

The Specific Ion Monitoring (SIM) method with gas chromatography-chemical ionization-mass spectrometry (GC-CI-MS) rapidly identifies and quantifies a chlorinated hydrocarbon pesticide

(toxaphene) and distinguishes it from strobane. Interferences from DDTs and Arochlor 1260 are eliminated or minimized. The procedure uses the SIM program and System 150 which compile data for toxaphene analysis, showing the effects of various interfering compounds and backgrounds. A 60-cm GC column condensed the range of toxaphene retention times while maintaining the characteristic 'toxaphene' pattern. The analysis takes 9 minutes. The entire run is normalized to the strongest spectral signal of two masses. The CI-MS of toxaphene is characterized by the major ion fragments, which reflect the substitution patterns of the toxaphene chlorine isomers. Both the m/e 307 and m/e 343 curves five similar intensities and either can be used for quantification, but the m/e width the least background interference should be used. The sensitivity of the mass spectrometer increased fourfold after cleaning. Application of this procedure in the New Orleans Drinking Water Survey is illustrated. (Auen-Wisconsin). W77-09633

CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY, Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering. J. P. Scherz, D. R. Crane, and R. H. Rogers. Available from the National Technical Information Service, Springfield, VA 22161 as N76-23663. Price codes: A03 in paper copy, A01 in microfiche. Bendix Aerospace Systems Div. Report BSR 4197, September 1975. 26 p. 12 fig., 5 ref. NGL 50-002-127, NAS 5 20942.

Descriptors: *Trophic level, *Reflectance, *Remote sensing, *Lake, *Satellites, *Water quality, *Spectroscopy, *Monitoring, *Wisconsin, *Methodology, *Turbidity, *Color, *Algae, *Plant pigments, *Analytical techniques, *Pollutant identification. Identifiers: LANDSAT.

The technique developed by Bendix Aerospace Systems Division for application to LANDSAT signals to define lake water quality is described. By use of distilled water samples in the laboratory and very clear lakes in the field, atmospheric and surface noise effects can be removed, allowing the residual signal to indicate only the material in the water. When this material is living algae or weeds, its concentration is related to the trophic level of the lake. The Bendix Multispectral Data Analysis System provided a color categorized image of several hundred Wisconsin lakes. These lakes were categorized for tannin or non-tannin waters, and for the degrees of algae, silt, weeds, and bottom effects. The optimum time to categorize lakes was found to be late August, when the algae and weed biomass is at a maximum. (Auen-Wisconsin). W77-09634

CONTINUOUS ON-LINE MONITORING OF TOTAL ORGANIC CARBON, Air Force Civil Engineering Center, Tyndall AFB, Fla. B. D. Bennett. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 175. Price codes: A02 in paper copy, A01 in microfiche. Report No. AFCEC-TR-75-16, August 1975. 23 p., 7 fig., 8 ref.

Descriptors: *Waste water treatment, *Monitoring, *Organic matter, *Carbon, *Oxygen demand, *Equipment, *Technology, *Analytical techniques, *Sewage treatment, *Florida, *Pollutant identification. Identifiers: *Total organic carbon analyzer, Tyndall AFB (Fla.).

Field evaluation of the Ionics, Inc., Model 1218 Total Organic Carbon Analyzer at a military post sewage treatment plant as an on-line monitoring of total organic carbon (TOC) in the wastewater stream in lieu of the usual BOD or COD analysis

demonstrated the analyzer's ability to measure TOC in domestic wastewater at 5-minute intervals. However, a significant degree of servicing was required to maintain the filtration system thus restricting its continuous operation. The filter was incapable of handling the level of suspended solids in the sample, resulting in filter clogging and loss of sample flow to the analyzer. Continuous on-line operation required frequent maintenance of compressed nitrogen, hydrochloric acid wash, and recording paper. Also periodic catalyst regeneration, infrared analyzer alignment, and valve block resurfacing require expertise and equipment not normally available at sewage treatment facilities. The frequent analysis of TOC is probably excessive for monitoring domestic wastewater, as an analysis at 30-60 minute intervals would suffice and reduce operational costs and maintenance requirements. The list price of the Ionics analyzer is \$12,250; the costs of related laboratory analysis varies widely. Its use at military base was not recommended. (Auen-Wisconsin) W77-09635

WATER SYSTEM VIRUS DETECTION, Organon Diagnostics, El Monte, Calif. A. S. Fraser, A. F. Wells, and H. J. Tenoso. Available from the National Technical Information Service, Springfield, VA 22161 as N76-19782. Price codes: A08 in paper copy, A01 in microfiche. Report No. NASA-CR-147491, November 1975. 167 p., 40 fig., 36 tab., 7 ref. Prepared for NASA Lyndon B. Johnson Space Center, Houston, Texas. NAS 9-14102.

Descriptors: *Water purification, *Monitoring, *Viruses, *Equipment, *Automatic control, *Bioindicators, *Viricides, *Bacteriophage, *Reclaimed water, *Analytical techniques, *Waste water treatment, *Pollutant identification. Identifiers: *Space capsules (Virus detection), *Space flights, *Interplanetary travel.

A viral contamination detection system monitors waste water reclamation during long space flights by testing the capability of the reclamation system to reject the passage of viruses into the recovered water. A non-pathogenic marker virus, bacteriophage F2, is fed into the process stream before the recovery unit and the reclaimed water is assayed for its presence. The marker virus provides for a 'worst-case' condition and thus supplies and equal, if not greater, challenge to the water purification process than any naturally occurring human pathogenic viruses. Detection of the marker virus in downstream reclaimed water consists of two major components—concentration and isolation of the bacteriophage, and detection of the marker virus. The concentration system involves adsorption of the virus to cellulose acetate filters in the presence of trivalent cations and low pH with subsequent virus desorption using small volumes of high pH buffer. Detection of the virus is performed by a passive immune agglutination test utilizing specially prepared polystyrene particles. Engineering schematics and drawings present a preliminary instrument design of a functional prototype capable of zero-gravity operation. The instrument consists of a reagent pump/metering system, reagent storage containers, a filter concentrator, an incubation/detector system, and an electronic readout and control system. (Auen-Wisconsin) W77-09636

MICROBIAL FORMATION OF VOLATILE SELENIUM COMPOUNDS IN SOIL, Cornell Univ. Agricultural Experiment Station, Ithaca, N. Y. Dept. of Agronomy. For primary bibliographic entry see Field 2G. W77-09648

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

EFFECT OF ORGANIC EXCRETION BY BENTHIC ANNELIDA ON THE PRODUCTIVITY OF PHYTOPLANKTON.
Institut Oceanographique, Paris (France).
Laboratoire de Physiologie des Etres Marins.
For primary bibliographic entry see Field 5C.
W77-09660

RENAL EXCRETION IN CHANNEL CATFISH FOLLOWING INJECTION OF QUINALDINE SULPHATE OR 3-TRI-FLUOROMETHYL-4-NITROPHENOL.
Fish and Wildlife Service, La Crosse, Wis. Fish Control Lab.
For primary bibliographic entry see Field 5C.
W77-09662

THE EFFECT OF TRICAIN METHANESULPHONATE (MS-222) ON THE MICROHAEMATOCRIT OF FISH BLOOD.
Randse Afrikaanse Universiteit, Johannesburg (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09665

THE EFFECT OF PARASITISM ON THE TOXICITY OF CADMIUM TO THE THREE-SPINED STICKLEBACK, GASTEROSTEUS ACULEATUS L.
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W77-09666

TOXICITY OF HYDROGEN SULFIDE TO VARIOUS LIFE HISTORY STAGES OF BLUEGILL (LEPOMIS MACROCHIRUS).
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-09668

THE TOXICITY OF MALATHION AND ITS HYDROLYSIS PRODUCTS TO THE EASTERN MUDMINNOW, UMBRA PYGMAEA (DEKAY).
Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 5C.
W77-09670

TOXIC ACTION OF SEVERAL LETHAL CONCENTRATIONS OF AN ANIONIC DETERGENT ON THE GILLS OF THE BROWN TROUT (SALMO TRUTTA L.).
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-09672

THE EFFECT OF MIREX ON THE BURROWING ACTIVITY OF THE LUGWORM (ARENICOLA CRISTATA).
Environmental Research Lab., Gulf Breeze, Fla.
For primary bibliographic entry see Field 5C.
W77-09675

ORGANIC CHLORINE PESTICIDES AND PCBS DISTRIBUTION IN TISSUES OF PURPLE HERON AND SPOON DUCK FROM THE BIOLOGICAL RESERVE OF DONANA (SPAIN).
Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Instituto de Quimica Organica General.
G. Baluja, M. A. Murado, and L. M. Hernandez.
Bulletin of Environmental Contamination and Toxicology, vol. 17, no. 5, p 603-612, 1977. 3 tab., 1 fig., 15 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Aroclor, Bird eggs, Birds, Water pollution effects, Path of pollutants, Laboratory tests, On-

site-investigation, *DDE, *DDT, *Dieldrin, Animal pathology, Animal disease, Animal populations, Marshes, *Ducks (Wild), *Pesticide residues, *Pollutant identification.
Identifiers: *Purple heron, *Spoon duck, *Spain, Ardea, Anas, *Organochlorine pesticides, Eggs.

From each specimen of purple heron and spoon duck, samples of muscle, liver, kidney, brain and gonad were obtained for individual analysis. DDT content was higher than the other pesticide residues found. DDE accumulation was particularly high in gonads and in eggs. A rapid build-up of residues in the heron species was observed in the course of 27 months. (Katz)
W77-09677

CONTINUOUS-FLOW APPARATUS FOR USE IN PETROLEUM BIOASSAY.
Battelle Pacific Northwest Labs., Sequim, Wash. Marine Research Labs.
J. R. Vanderhorst, C. I. Gibson, L. J. Moore, and P. Wilkinson.
Bulletin of Environmental Contamination and Toxicology, Vol 17, No 5, p 577-584, 1977. 2 tab., 5 fig., 19 ref.

Descriptors: *Bioassay, *Methodology, *Laboratory tests, *Laboratory equipment, Laboratories, Aquaria, Oil, *Oil pollution, Sea water, Water pollution effects, Statistical tests, Pollutant identification.
Identifiers: Long-term bioassays, Continuous-flow apparatus, *Crude oil, No 2 fuel oil, *Dispersed petroleum derivatives, Petroleum bioassay, Mariotte bottle, Stable concentration.

A continuous flow system for the long-term bioassay of dispersed petroleum derivatives in sea water was devised and tested. The possible application of the system to crude oils is discussed. (Katz)
W77-09681

USING OXYGEN DEMAND INDEX, COD, AND BOD TESTS TO CHARACTERIZE KRAFT MILL EFFLUENT.
Saint Mary's Univ., Halifax (Nova Scotia). Dept. of Chemistry.
E. R. Hayes, V. G. Munroe, and J. Spurr.
Water and Pollution Control, Vol 114, No 9, p 22, 25, 38-39, September, 1976. 2 fig., 9 ref.

Descriptors: *Pulp wastes, *Oxygen demand, *Chemical oxygen demand, *Biochemical oxygen demand, Water quality standards, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, *Effluents, Water quality, Water analysis, Testing, *Pollutant identification, *Waste identification.
Identifiers: Kraft mills.

BOD, COD, and oxygen demand index (ODI) measurements were made on a total kraft mill effluent, and COD and ODI tests were made on alkaline sewer, acid sewer, and woodroom effluents. The data suggest that ODI tests can be used to quickly predict COD values once a COD:ODI ratio has been established for the particular waste water. (Buchanan-IPC)
W77-09729

CHARACTERIZATION OF SPENT BLEACHING LIQUORS. PART 1. SPENT LIQUORS FROM THE CHLORINE AND ALKALI EXTRACTION STAGES IN THE PREBLEACHING OF PINE KRAFT PULP.
Swedish Forest Products Research Lab., Stockholm.
H. L. Hardell, and F. de Sousa.
Svensk Papperstidning, Vol. 80, No. 4, p 110-120, March 10, 1977. 7 fig., 20 ref., 6 tab.

Descriptors: *Bleaching wastes, *Waste identification, *Water analysis, Biodegradation, Wastes,

*Industrial wastes, Water pollution sources, Chlorine, Carbon, Color, Carbohydrates, Organic compounds, Pulp and paper industry, Waste water (Pollution), Water pollution, Pine trees, Effluents, *Pulp wastes.
Identifiers: Kraft pulp, Kraft mills, Galactose, Chlorine compounds.

Spent chlorination liquor (SCL) and spent alkaline extraction liquor (SEL) were examined for total dry content, inorganic Cl, organically bound Cl, organic C, color, and carbohydrate composition. Distributions of relative molecular mass in both liquors were studied by ultrafiltration. About 24 kg organic matter per metric ton of bleached pulp was dissolved in the SCL, 52 kg in the SEL; about 60% of the former and 20% of the latter was relatively low-molecular weight material, indicating that the average molecular weight of dissolved organic material was much higher in the SEL than in the SCL. Most (84%) of the color formed during the 2 prebleaching stages was found in the SEL, derived mainly from higher-molecular weight materials. During bleaching, 63 kg of active Cl per ton of pulp was charges, of which ca. 44 kg was found as chloride and 3 kg as organically bound Cl in the SCL, compared with 9 kg and 3 kg, respectively, in the SEL, which made the weight percentage of organically bound Cl ca. 16% and 18% of the total organic matter in the SCL and SEL, respectively. The SCL contained ca. 0.4 kg and the SEL ca. 2.8 kg of carbohydrates per ton of bleached pulp. Most of them were found in the relatively high-molecular weight fractions. Galactose content was particularly high. When the liquors were treated with air to stimulate degradation in the recipient waters, organic C decreased ca. 50% and color ca. 20% in both SCL and SEL after 5 months. The major changes occurred during the first 40-50 days, showing that much of the material is relatively resistant to natural degradation. No enrichment of Cl-containing organic matter was noted. (Brown-IPC)
W77-09731

STUDIES AND COMPARISONS OF DETERMINATIONS OF PHENOLS IN WATER: APPLICATION TO THE EXAMINATION OF A PAPER MILL EFFLUENT (ETUDES ET COMPARAISONS DES DETERMINATIONS DES PHENOLS DANS LES EAUX: APPLICATION A L'EXAMEN D'UN REJET DE PAPIETERIE).
Besancon Univ. (France). Institut de Chimie.
R. Jacquemain, F. Remy, and C. Guinchard.
Journal Francais d'Hydrologie, Vol. 16, p 25-32, 1975. 10 ref. 5 tab.

Descriptors: *Pollutant identification, *Water analysis, *Phenols, *Pulp wastes, *Analytical techniques, Wastes, *Industrial wastes, Water pollution sources, Colorimetry, Chromatography, Spectroscopy, Pulp and paper industry, Aromatic compounds, Organic compounds, Water properties, Water chemistry.

Colorimetric, chromatographic, and IR-spectroscopic methods for determining phenols in water were compared. IR spectroscopy was found to be the most reliable method, but requires considerable equipment. The two colorimetric methods (4-aminoantipyrine and p-nitroaniline) gave greatly different results. The chromatographic studies showed that 4-aminoantipyrine reveals only the simple phenols while p-nitroaniline also discloses a large group of complex phenols. The effluent from a sulfite pulp mill was analyzed qualitatively for phenols using thin-layer chromatography and quantitatively using the two colorimetric methods and IR spectroscopy. The 4-aminoantipyrine method showed 2.5 mg/liter of simple phenols; the p-nitroaniline method, 90 mg/liter of simple and complex phenols. (Speckhard-IPC)
W77-09736

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL

Israel Oceanographic and Limnological Research Ltd., Haifa.
I. Roth, and H. Hornung.

Environmental Science and Technology, Vol 11, No 3, p 265-269, March, 1977. 44 ref, 8 tab.

Descriptors: *Water analysis, *Heavy metals, *Pollutant identification, Sediments, Fish, *Copper, *Lead, *Nickel, *Zinc, *Chromium, Water pollution sources, Trace elements, Metals, Spectrophotometry, Cadmium.
Identifiers: *Mediterranean Sea (Israel), *Israel.

Water, sediment, and fish were collected along the northern part of the Mediterranean coast of Israel and analyzed for cadmium, lead, copper, zinc, nickel, and chromium by atomic absorption spectrophotometry. The obtained values showed no significant heavy metal pollution in the studied area, compared with values found in the literature for metal concentrations in other parts of the world. (Witt-IPC)

W77-09742

CHARACTERIZATION AND TREATMENT OF TEXTILE DYEING WASTEWATERS

Crompton and Knowles Corp., Reading, Pa.

For primary bibliographic entry see Field 5D.
W77-09745

GAS STRIPPING, SORPTION, AND THERMAL DESORPTION PROCEDURES FOR PRECONCENTRATING VOLATILE POLAR WATER-SOLUBLE ORGANICS FROM WATER SAMPLES FOR ANALYSIS BY GAS CHROMATOGRAPHY

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
P. P. K. Kuo, E. S. K. Chian, F. B. DeWalle, and J. H. Kim.

Descriptors: *Water analysis, *Organic compounds, *Pollutant identification, *Gas chromatography, Water pollution sources, *Analytical techniques, Sorption, Trace elements, Water chemistry, Water quality, Separation techniques.

The efficiencies of (1) the removal of organic compounds from aqueous solution by gas stripping, (2) the adsorption of the stripped organics on Tenax-GC adsorbent, and (3) the thermal desorption of the organics from the adsorbent were determined using volatile polar water-soluble organics as the principal model compounds. Good mixing between the stripping gas and the liquid phase being stripped, as provided by the Bellar and Lichtenberg stripping apparatus, results in the effective removal of organics. Stripping the compounds at an elevated temperature is suggested. Breakthrough and displacement of lower alcohols occurs on the Tenax-GC under the experimental conditions. The adsorption and the desorption efficiencies are better than 75% and 80%, respectively, for the majority of the compounds studied. The procedures for gas stripping, sorption, and thermal desorption are discussed to achieve a reliable analytical method for determining volatile polar water-soluble organics in water by gas stripping/gas chromatographic analysis. The detection limits are at the ppb level or lower for most of the compounds studied. (Witt-IPC)

W77-09746

DETERMINATION OF ARSENIC SPECIES IN NATURAL WATERS

Scripps Institution of Oceanography, La Jolla, Calif.
M. O. Andreae.

Analytical Chemistry, Vol 49, No 6, p 820-823, May, 1977. 4 fig, 9 ref, 1 tab.

Descriptors: *Water analysis, *Arsenic compounds, *Pollutant identification, Natural streams, Water pollution sources, *Analytical techniques, *Gas chromatography, Separation techniques, *Trace elements, Water chemistry, *Methodology.

A method is described for the determination of arsenate, arsenite, mono-, di-, and trimethyl arsine, monomethylarsonic and dimethylarsinic acids, and trimethylarsine oxide in natural waters with detection limits of several nanograms/liter. The arsines are volatilized from the sample by gas stripping; the other species are then selectively reduced to the corresponding arsines and volatilized. The arsines are collected in a cold trap cooled with liquid nitrogen. They are then separated by slow warming of the trap or by gas chromatography, and measured with atomic absorption, electron capture, and/or flame ionization detectors. Four arsenic species have been found and measured in natural waters. (Witt-IPC)

W77-09747

DETERMINATION OF FREE AND TOTAL POTENTIAL HALOFORMS IN DRINKING WATER

Ontario Ministry of the Environment, Rexdale. Lab. Service Branch.

A. A. Nicholson, O. Meresz, and B. Lemyk.
Analytical Chemistry, Vol. 49, No. 6, p 814-819, May 1977. 11 fig, 23 ref, 9 tab.

Descriptors: *Water analysis, *Potable water, *Halogens, *Pollutant identification, Water pollution sources, *Analytical techniques, Organic compounds, *Trace elements, *Water chemistry, Methodology, *Halides.

A convenient easily automated method is presented for the analysis of haloforms and some other volatile organohalides in drinking water. This direct aqueous injection (DAI) method has a detection limit at or below 1 microgram/liter for haloforms. Simultaneous analysis of finished drinking water samples with the DAI and the gas sparging methods revealed hitherto unknown aspects of water treatment chemistry. While the gas sparging techniques measures only the free haloforms present in the drinking water, the DAI method measures the total potential haloforms that can form after chlorination. (Witt-IPC)

W77-09748

CHROMATOGRAPHY OF CHLORINATED BIPHENYLS ON AN ION-EXCHANGE RESIN

Colorado Univ., Boulder. Dept. of Chemistry.

T. Hanai, and H. F. Walton.
Analytical Chemistry, Vol. 49, No. 6, p 764-766, May 1977. 6 fig, 6 ref, 1 tab.

Descriptors: *Water analysis, *Pollutant identification, *Ion exchange, *Polychlorinated biphenyls, Trace elements, Water pollution sources, Chromatography, Resins, Calcium, Water chemistry, Cation exchange, Separation techniques.
Identifiers: Polystyrene.

A calcium form crosslinked polystyrene-type cation-exchange resin is a suitable stationary phase for the chromatography of chlorinated biphenyls, using aqueous acetonitrile as the eluent. Substitution of chlorine atoms in the 2 position lessens the retention, but substitution in other positions increases it. Seventeen substituted biphenyls were studied over a range of temperatures and solvent compositions, and their ultraviolet absorption spectra are shown. The method is applicable to traces of byphenyls in contaminated water. (Witt-IPC)

W77-09749

DETERMINATION OF MOLYBDENUM IN SEA-WATER BY ELECTRON PARAMAGNETIC RESONANCE SPECTROMETRY

New Hampshire Univ., Durham. Dept. of Chemistry.

For primary bibliographic entry see Field 2K.
W77-09750

DETERMINATION OF NITRILOTRIACETATE IN ENVIRONMENTAL WATER BY GAS CHROMATOGRAPHY OF THE TRIMETHYLSILYL ESTER

Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

R. J. Stolzberg, and D. N. Hume.
Analytical Chemistry, Vol. 49, No. 3, p 374-378, March, 1977. 1 fig, 19 ref, 5 tab.

Descriptors: *Water analysis, *Pollutant identification, *Gas chromatography, *Nitrilotriacetic acid, Trace elements, Analytical techniques, Water chemistry, Water pollution sources, Separation techniques.

A rapid simple method for the determination of trace levels of nitrilotriacetate (NTA) in aqueous samples is based on gas chromatography of the trimethylsilyl derivative. The 1 ml sample is evaporated directly in the reaction vial with an excess of the ammonium salt of ethylenediamine tetraacetic acid to mask interfering cations and convert NTA to a reactive form. After evaporative drying with methylene chloride, derivatization is carried out with bis(trimethylsilyl) trifluoroacetamide in dimethylformamide. Chromatography on OV-17 columns gives good separation from all common anions, organic acids, and aminopolycarboxylate chelating agents. The method is suitable for samples containing 1-100 micrograms/ml NTA without a prior concentration step. A minor modification permits simultaneous determination of iminodiacetate and glycine which are produced in the photodegradation of NTA. (Witt-IPC)

W77-09751

ENRICHMENT OF TRACE METALS IN WATER BY ADSORPTION ON ACTIVATED CARBON

Antwerp Univ., Wilrijk (Belgium). Dept. of Chemistry.

B. M. Vanderborcht, and R. E. Van Grieken.
Analytical Chemistry, Vol. 49, No. 2, p 311-316, February, 1977. 5 fig, 17 ref, 7 tab.

Descriptors: *Water analysis, *Trace elements, *Metals, *Activated carbon, *Pollutant identification, *Adsorption, Water pollution sources, Analytical techniques, Chemical analysis, Inorganic compounds, Chelation.

A combination of multielement chelation by 8-hydroxyquinoline with subsequent adsorption on activated carbon was developed for trace metal preconcentration. Adsorption characteristics of 8-quinolinol and metal quinolates on activated carbon were investigated in order to optimize the enrichment procedure. Interferences from alkali and alkaline earth ions were minimized, and working conditions for preconcentration from very differing samples were calculated. An enrichment factor of 10,000, a precision of 5-10%, and a recovery from 85 to 100% were demonstrated for about 20 elements simultaneously. (Witt-IPC)

W77-09752

AUTOMATED CATALYTIC ULTRAMICRODETERMINATION OF MANGANESE IN NATURAL WATERS WITH A MINIATURE CENTRIFUGAL ANALYZER

Illinois Univ. at Urbana-Champaign. School of Chemical Sciences.

For primary bibliographic entry see Field 2K.
W77-09753

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

THE DETERMINATION OF MOLYBDENUM AND TUNGSTEN IN SEA AND SURFACE WATER.

Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center. H. A. Van der Sloot, G. D. Wals, and H. A. Das. *Analytica Chimica Acta*, Vol 90, No 1, p 193-200, May, 1977. 3 fig, 10 ref, 5 tab.

Descriptors: *Water analysis, *Pollutant identification, *Molybdenum, *Sea water, Heavy metals, Surface waters, Water pollution sources, Trace elements, Activated carbon, Hydrogen ion concentration, Analytical techniques, *Water chemistry, Metals.
Identifiers: *Tungsten.

A simple method for the determination of molybdenum and tungsten in sea and surface water is presented. Molybdenum and tungsten are concentrated on activated charcoal by adsorption as the ammonium pyridine dithiocarbamate complex; the optimal pH for adsorption is 1.3. Molybdenum and tungsten are then determined by thermal neutron activation. The detection limits are 0.05 micrograms Mo/liter and 0.05 micrograms W/liter (or 0.001 micrograms W/liter after a simple chemical separation). (Witt-IPC)
W77-09754

CATALYTIC DEOXYGENATION OF AQUEOUS SOLUTIONS BY HYDRAZINE.

Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
For primary bibliographic entry see Field 5B.
W77-09766

EVALUATION OF A LABORATORY MICROCOSM FOR STUDY OF TOXIC SUBSTANCES IN THE ENVIRONMENT: FINAL TECHNICAL REPORT, JULY 1, 1973-DECEMBER 31, 1975.

Illinois Univ. at Urbana-Champaign.
R. L. Metcalf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 982. Price Codes: A04 in paper copy, A01 in microfiche. National Science Foundation, RANN Report NSF-RA-E-75-116, 1975. 66 p., 10 tab., 9 fig., 17 ref.

Descriptors: Environment, *Environmental effects, *Bioassay, *Toxicity, Pesticides, Model studies, *Methodology, Laboratory technique, Laboratory equipment, Trace elements, Path of pollutants, *Degradation(Decomposition), Public health, Pollutant identification.
Identifiers: Environmentally congenial products, *Environmental fate, *Degradation pathways, Ecological magnification, Biodegradability, Laboratory microcosm.

A simple model ecosystem technology is described, which can yield, at modest expense, a wealth of valuable information about pesticides, drugs, plasticizers, industrial chemicals, carcinogens, and trace metals. Described is the value of the laboratory microcosm in (1) prescreening new chemicals at an early stage in their development; (2) developing environmentally congenial products; (3) tracing environmental fate and degradation pathways, toxicity, ecological magnification, biodegradability index and unextractable radioactivity. (Katz)
W77-09769

STANDARDIZATION OF METHYLMERCURY ANALYSIS.

Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering. P. A. Krenkel, and W. D. Burrows.
Available from the National Technical Information Service, Springfield, VA 22161 as COM-75-10673. Price codes: A05 in paper copy, A01 in microfiche. Final Report for NOAA National

Marine Fisheries Service, Contract N-042-56-72(NFA), RC-2052-11, February 1975. 70 p, 9 tab, 16 fig, 59 ref.

Descriptors: *Mercury, *Metals, *Water analysis, Laboratory tests, *Methodology, Chlorides, *Chromatography, Organic compounds, Halides, Spectrophotometry, Enzymes, Water quality standards.

Identifiers: *Methylmercury analysis, *Benzene, Papain, Gas-liquid chromatography, Proteolytic enzymes, Colorimetric metals, Atomic absorption spectrophotometry, Thin layer chromatography, Standard curve preparation.

In order to develop a simple, concise analytical technique for methylmercury, an investigation was made of existing methods; experiments were conducted to refine analysis by gas-liquid chromatography; and the resulting method was put forward in a form for easy use by laboratory technicians. A review of recent literature includes description of the use of colorimetric, gas-liquid chromatographic, atomic absorption spectrophotometric and thin layer chromatographic methods of measuring methylmercury and explains the extensive sample preparation necessary. It was found that simple treatment with papain had no effect on methylmercury recovery and benzene was the organic solvent preferred. Other reagents which proved most efficient were the bromide form of halide reagents and sodium thiosulfate for extracting the methylmercury into the aqueous phase. Peak height was proportional to peak area when samples of 0 to 5 ng were injected. Methylmercury bromide and chloride were both more stable for use as standards than was the iodide. Distillation of the final benzene extract was a practical means of increasing the methylmercury concentration, with about 10% of the mercury lost during distillation. (Katz)
W77-09775

COMPUTER INTERPRETATION OF POLLUTANT MASS SPECTRA.

Cornell Univ., Ithaca, N.Y.
F. W. McLafferty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 341. Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency, Environmental Monitoring Series, Report EPA 600/4-76-046, October, 1976. 59 p, 12 tab, 6 fig, 22 ref.

Descriptors: *Chemical analysis, *Methodology, Laboratory tests, Laboratory equipment, *Computer programs, Computers, *Mass spectrometry, Algorithms, *Information retrieval, Organic compounds, Water pollution, *Pollutant identification, Chemicals, *Organic wastes.
Identifiers: Chemical pollutants, Environmental protection.

The objective was to improve systems for computer examination of the mass spectra of unknown pollutants. For this a new probability based matching (PBM) system was developed for the retrieval of mass spectra from a large data base, and the interpretation of unknown mass spectra using the self-training interpretive and retrieval system (STIRS) was substantially improved. PBM was designed as a prefilter to STIRS; if an unknown mass spectrum can be identified with a sufficiently high confidence by PBM, interpretation of the spectrum using STIRS is not necessary. The PBM system provides more efficient retrieval than presently accepted systems; it incorporates a 'reverse search' algorithm, and through the use of weighted mass and abundance data provides a statistically valid prediction of the confidence of the matches found. STIRS has been improved to give a confidence-level prediction of the presence of 200 particular substructural features in the unknown molecule. Extensive studies have been made to improve the data selection for most data classes used by STIRS, resulting in a much higher level of overall system performance. Operation efficient-

cies of both PBM and STIRS have been improved dramatically so that both require less than 1 minute on a laboratory PDP-11/45 computer. (Katz)
W77-09776

WATER QUALITY: WESTERN FISH TOXICOLOGY STATION AND WESTERN OREGON RIVERS.

Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
D. F. Samuelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 914. Price codes: A04 in paper copy, A01 in microfiche. EPA Ecological Research Series, Report EPA-600/3-76-077, September 1976. 55 p, 14 tab, 19 fig, 21 ref.

Descriptors: Water quality, Seasonal, *Oregon, Rivers, River basins, Water temperature, Oxygen, Dissolved oxygen, Hydrogen ion concentration, Alkalinity, *Water properties, Water sampling, *Iron, *Manganese, *Zinc, Anions, Cations, *Pollutant identification.
Identifiers: Seasonal variation, Well waters, *Willamette River discharges(Ore), Corvallis(Ore).

Seasonal variation in water quality was compared for the Western Fish Toxicology Station (WFST), Corvallis, OR, the adjacent Willamette River and approximately 40 major western Oregon rivers from 1972 through 1974. Water temperature patterns of the Willamette River and the WFST well were similar (range, 4.6-20.0C). While both displayed seasonal trends, well water lagged 7-10 days behind the river in both temperature increases and decreases. Dissolved oxygen values in both the river and well water were inversely related to temperature. Average dissolved oxygen concentrations were higher in the river (10.4 mg/l) than in the well water (4.1 mg/l). Hydrogen ion concentration (ph) was low in the well water (range, 6.6-7.0), compared to the river (range, 7.0-7.8). River water had a mean hardness and alkalinity of 22 mg/l and 23 mg/l respectively, while well water ranged between 'soft to moderately hard' (mean hardness, 34 mg/l; mean alkalinity, 31 mg/l). High Willamette River discharges (above Corvallis) were followed by a 7-10 day lag in corresponding sharp peaks of total hardness, alkalinity, and certain cations and anions in the well water. Major cation and anion concentrations were low overall. Trace metals were at or near detection limits. River iron and manganese concentrations were approximately 10 times greater than those found in the well. River zinc had a mean of 9.4 ug/l, while the well water mean concentration was 5.1 ug/l. (Katz)
W77-09777

ANALYSIS OF DATA FROM BIOLOGICAL SURVEYS OF STREAMS: DIVERSITY AND SAMPLE SIZE.

Kansas Univ., Lawrence. Dept. of Geology; and Kansas Univ., Lawrence. Museum of Invertebrate Paleontology.
R. L. Kaesler, and E. E. Herricks.
Water Resources Bulletin, Vol 12, No 6, p 125-135, December 1976. 2 tab, 5 fig, 25 ref. OWRT C-6007(5200)(4).

Descriptors: Analytical techniques, *Biological communities, Streams, *Surveys, *Statistical methods, *Benthic fauna, Water pollution effects, On-site data collections, Benthos, Sampling, Ecological distribution, Pollutant identification.
Identifiers: Brillouin's Equation, Shannon's diversity index, *Species diversity index.

Brillouin's equation (H) for species diversity from information theory is to be preferred for the purposes of applied ecology over the equation of Shannon (H') or the more commonly used approximate equation (H''). By its use, the difficult

problem of delimiting the extent of the community being sampled in a stream survey can be avoided. Moreover, Brillouin's equation gives the exact diversity of the fully censused collection, whereas Shannon's diversity can only be approximated with a biased estimator. If a sample is regarded as a message from the environment to the ecologist, Brillouin's equation is the proper one for computing its diversity. The product moment correlation coefficient between Brillouin's H for the total number of individuals from a group of samples and for randomly chosen subsets of 100 individuals from each sample was nearly as high as the correlation between H and H' based on the total samples. This indicates that small sample sizes may give a useful diversity index. Replicated subsamples show that much smaller samples than are normally used can discriminate between communities from polluted and unpolluted environments. The use of smaller samples should reduce the cost of stream surveys. (Katz)

W77-09778

LEAD AND FRESHWATER FISHES: PART 2—IONIC LEAD ACCUMULATION,

Commission of the European Communities, Ispra (Italy). Joint Research Centre.

For primary bibliographic entry see Field 5C.

W77-09779

ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSES: ASSISTANCE PROJECTS, FY 75,

Environmental Research Lab., Athens, Ga. Analytical Chemistry Branch. A. L. Alford.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 425. Price codes: A03 in paper copy, A01 in microfiche. EPA Environmental Monitoring Series, Report EPA-600/4-77-004, January, 1977. 37 p., 9 tab., 14 ref.

Descriptors: *Methodology, *Chemical analysis, *Water analysis, *Organic compounds, *Mass spectrometry, Gas chromatography, *Trace elements, Laboratory tests, Laboratory equipment, On-site investigations, *Water pollution, *Pollutant identification, Instrumentation, *Analytical techniques.

Identifiers: *Multielement analysis, *Spark source mass spectrometry.

W77-09782

EFFECTS OF AROCLOR (R) 1254 ON BROOK TROUT, SALVELINUS FONTINALIS,

Environmental Research Lab., Duluth, Minn.

For primary bibliographic entry see Field 5C.

W77-09783

ESTIMATION OF PERMISSIBLE CONCENTRATIONS OF POLLUTANTS FOR CONTINUOUS EXPOSURE,

Research Triangle Inst., Research Triangle Park, N.C.

R. Handry, and A. Schindler. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 959. Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/2-76-155, June 1976. 136 p., 31 fig., 33 tab., 19 ref., 3 append.

Descriptors: *Toxins, Pollutants, *Standards, *Air pollution, *Potable water, *Estimating, Hazards, Safety, Human diseases, Public health, Toxicity, Lethal limit.

Identifiers: *Continuous pollutant exposure, *Permissible levels, Carcinogens, Tolerance levels.

Pollutant hazard criteria are developed for toxic materials in ambient air and drinking water for which no safe concentration levels have been established, to serve as a guide in assessing potential hazards in lieu of official standards. The methodology for estimating permissible pollutant levels is presented. Hazard criteria are expressed as a ratio (actual pollutant concentration/permissible pollutant concentration). When this quotient is equal to or greater than one, a pollution hazard is judged to exist. Several approaches were used to estimate safe concentration values. Estimates for air pollution were based on episodes of continuous exposure and on total volume to body weight relationships of infants, to take into consideration the higher pulmonary intake per unit weight of young children. Permissible pollutant concentrations in drinking water were developed along the same lines. Final expressions were used to treat multipollutants in both air and drinking water. A means for estimating lung cancer mortality risk as a function of carcinogen concentrations in ambient air is presented; it allows determination of carcinogen air levels to which nonsmokers are exposed and to estimate the lung cancer mortality for nonsmokers exposed to any carcinogen concentration in air. The results are expressed as risk vs. carcinogen concentration. (Auen-Wisconsin)

W77-09788

ANNOTATED EXTRACTS OF SOME PAPERS DEALING WITH THE MEASUREMENT AND SOLUBILITY OF DISSOLVED ATMOSPHERIC GASES, WITH NITROGEN GAS SUPERSATURATION, AND WITH GAS BUBBLE DISEASE IN FISH,

British Columbia Water Resources Service, Victoria.

For primary bibliographic entry see Field 5C.

W77-09792

METHOD FOR DETECTING OIL IN WATER,

P. T. Thyrum. U.S. Patent No. 4,004,453, 5 p., 4 fig., 4 ref.; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1472, January 25, 1977.

Descriptors: *Patents, *Oil pollution, Water quality control, *Water pollution control, *Pollutant identification, Measurement, Dispersions, Dyes, Filters, *Oil wastes.

Simple and economical methods accurately determine low concentrations of particulate oil in water. In one method a sample of water is first filtered at a controlled rate. A dye-impregnated pad is pressed against the upstream surface of the filter element and then removed. The upstream surface of the filter element may now be observed with the eye against colorations of known concentrations for variations in color intensity clearly discernible within the range of 0 and 30 ppm by volume of oil-in-water. The dye-impregnated pad is prepared by submerging a white absorbent material in a saturated solution of an oil-soluble, water-insoluble dye, and drying them in a rack under vacuum. In another method, where the sample also contains discoloring pigmented contaminants, an intermediate pad is pressed between the filter element and the dye-impregnated pad, and its coloration compared to known standards. In lieu of the intermediate pad method, a thin prefilter is placed on the upstream surface of the filter element during filtering, then discarded, and the filter element is processed as described in the first method. (Sinha-OEIS)

W77-09813

EXPERIENCES WITH THE ORGANIC CARBON ANALYZER (TOC) BY MERZ FOR ROUTINE MONITORING AT THE BASF PURIFICATION PLANT (ERFAHRUNGEN MIT DEM TOC-SCHNELLBESTIMMER NACH MERZ IN DER ROUTINEÜBERWACHUNG DER BASF),

L. Buechs, and W. Merz.

Vom Wasser, Vol. 47, p 267-274, 1977. 3 fig., 3 tab., 3 ref.

Descriptors: *Pollutant identification, *Organic carbon, Analytical techniques, Monitoring, Effluents, Chemical oxygen demand, Water pollution control, Automation, Water purification, Cooling water, Organic matter, *Waste water treatment.

The analysis of treatment plant effluent and river water by the use of Merz's rapid TOC analyzer was discussed. TOC (total organic carbon) as a measure of the concentration of organic substances is more effective in monitoring received water than COD, which only measures chemical oxidizability. Methods were compared for measuring both TOC and COD in potable water, non-contaminated cooling water, and effluents with various levels of contamination. Rapid TOC analysis was more accurate and less prone to interference than COD methods. The TOC method can be completely automated. (Collins-FIRL)

W77-09894

IDENTIFICATION OF THE VIRUCIDAL AGENT IN WASTE WATER SLUDGE,

Sandia Labs., Albuquerque, N. Mex.

R. L. Ward, and C. S. Ashley.

Applied and Environmental Microbiology, Vol. 33, No. 4, p 860-864, April, 1977. 3 fig., 4 ref.

Descriptors: *Viricides, *Viruses, *Ammonia, *Sludge treatment, Hydrogen ion concentration, Anaerobic digestion, Organic compounds, Chemical analysis, *Waste water treatment.

Experiments were conducted to determine the identity of a viricidal agent in sludge. Raw and anaerobically digested sludge samples were mixed with a 10-fold dilution of virus and incubated. Sodium dodecyl sulfate was added to break up viral aggregates. General properties of the agent were determined. It was found to be small and heat stable. Attempts at isolation by distilling digested sludge recovered more than 95% of viricidal activity in the first 15% of the distillate. A fraction of the first 10% of the distillate was treated with activated charcoal since the agent was thought to be a small, volatile, organic compound. Ammonia was recovered from this process and tested, as ammonium chloride, to determine its viricidal activity. The results proved that ammonia was the source of poliovirus inactivation. Viricidal activity was evidenced by ammonia only at a pH greater than 8, and increased with increasing pH values. Viricidal activity in raw sludge was similarly pH-dependent. These results applied to poliovirus type 1 strain CHAT. Further tests showed that ammonia was an effective viricide for the picornavirus group, but that reovirus was insensitive to ammonia under these conditions. It was suggested that raising the pH of sludge would be effective in inactivating sludge viruses. (Collins-FIRL)

W77-09897

STERIODS AS SEWAGE SPECIFIC INDICATORS IN NEW YORK BIGHT SEDIMENTS,

National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.

P. G. Hatcher, L. E. Keister, and P. A. McGilivray.

Bulletin of Environmental Contamination and Toxicology, Vol 17, No 4, p 491-498, April, 1977. 2 fig., 22 ref.

Descriptors: *Bioindicators, *Indicators, *Water pollution sources, *Sediments, *Analysis, Sludge

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

disposal, Waste disposal, Analytical techniques, Water quality, *Pollutant identification, Human wastes.
Identifiers: *New York Bight, *Steroids, Coprostanol, 24 Beta-ethyl coprostanol.

Steroids associated with human fecal matter were suggested as sewage pollution indicators in marine sediments. Some of these, such as coprostanol, have not been detected in unpolluted marine sediments and would be useful as indicators. An analysis of the New York Bight sediment was conducted to evaluate this theory. Steroids were determined in freeze-dried sediments and in sewage sludge. The major steroids found in two sediment samples, one taken from a near-shore site and the other from a sewage sludge dumpsite, were coprostanol, cholesterol, beta-sitosterol, and 24 beta-ethyl coprostanol. Of these, cholesterol and beta-sitosterol were present in significant quantities. These steroids are usually dominant in marine sediments. coprostanol and 24 beta-ethyl coprostanol in the bight sediment linked the major organic component of the muds to sewage. Coprostanol concentrations in the two sediments were 4.8 and 5.2 ppm, which indicated a similar level of sewage contamination. Thus the near-shore sample indicated as much contamination as the sample from a basin heavily impacted by sewage. Analysis of a New York City treatment plant's sludge revealed large amounts of coprostanol and 24 beta-ethyl coprostanol. This confirmed the results of the sediment analysis. It was concluded that coprostanol or 24 beta-ethyl Coprostanol could be used to identify sediment sewage contamination on a horizontal or vertical sedimentary profile. (Collins-FIRL)
W77-09901

CHEMICAL COMPOSITION OF SEWAGE SLUDGES AND ANALYSIS OF THEIR POTENTIAL USE AS FERTILIZERS.
Purdue Univ., Lafayette, Ind. Dept. of Agronomy. L. E. Sommers.
Journal of Environmental Quality, Vol 6, No 2, p 225-232, April-June, 1977. 7 fig, 6 tab, 26 ref.

Descriptors: *Sludges, *Fertilizers, Chemical properties, *Carbon, *Nitrogen, *Phosphorus, *Potassium, Metals, Sludge treatment, Waste disposal, Evaluation, Analysis.

A regional study was conducted to determine the fertilizer values of various sludges. These values are based on sludge nitrogen, potassium, and phosphorus concentrations as well as on trace metal content. Comparisons were based on common treatment processes because of the variability in sources of treated effluent and treatment plants. Major consideration was given to sludges treated by anaerobic and aerobic processes. The study evaluated thirty chemical components of sludges. The median values of the components were used to summarize the data. Total N, NH₄, and metals were the prime parameters for land application rates, and the most variable. Organic carbon was 20-30% of total carbon; 1-4% was identified as inorganic carbon. Anaerobic treatment produced lower organic carbon. Total nitrogen varied 2-4%, with a significant amount identified as NH₄. Storage of anaerobic sludges may produce nitrates. Liquid sludges may contain 50-90% nitrogen in organic combinations. The sludge handling system affects the type of inorganic nitrogen in sludge. Total phosphorus was about 1.2-3.0% with 10-30% of this present as organic phosphorus. Sludge handling had no effect upon phosphorus content. Nitrogen, phosphorus, and potassium concentrations were in a narrow range, whereas that of lead, zinc, copper, nickel, and cadmium were extremely variable. It was concluded that N, P, and K were present in the approximate ratio of 11:7:6.1. About 1% of agricultural lands would be needed for sludge application at the rate of 100 kilograms of available nitrogen/hectare in most of the states evaluated. A knowledge of the chemical composition of individual sludges must be obtained before land application. (Collins-FIRL)

W77-09904

ZETA POTENTIAL MEASUREMENT,
H. G. Swope.

Water and Sewage Works, Reference Issue, p 64-67, April, 1977. 6 fig, 8 ref.

Descriptors: *Zeta potential, *Measurement, *Flocculation, *Coagulation, Electrical properties, Colloids, Turbidity, Alkalinity, Hydrogen ion concentration, Polymers, Polyelectrolytes, Corrosion control, *Waste water treatment.
Identifiers: Alum.

Zeta potential measurement aids the determination of proper flocculation agents and amounts to remove particulate matter and colloids for the complete clarification of water or waste water. The zeta potential describes the movement of suspended particles in water towards the anode or cathode after establishment of an electrical potential gradient. This movement is known as electrophoresis or ionic migration. The development of the Zeta-Meter has increased the usefulness of this phenomenon. Experimentation has been applied to alum coagulation to control the coagulation of raw water colloids. Colloid removal is only possible with a reduction of the zeta potential. Raw water turbidity consists of finely divided silt and clay and organic matter undergoing microbial decomposition. The turbidity is of a fine fraction and a coarse fraction. The first cannot be removed by usual alum coagulation. Both floc and colloid zeta potential should be reduced to zero plus or minus 5 mV, by use of an inorganic coagulant and an appropriate organic polyelectrolyte. Floc produced by minimum dosages is too electronegative to produce colloid removal. Water alkalinity depletion is a problem which can result in severe corrosion problems, especially below 6 mg/liter. Such a point may be reached before alum addition has become sufficient to achieve the proper zeta potential. The addition of unreacted aluminum sulfate can inhibit corrosion. Polyelectrolytes produce large zeta potential changes without disturbing pH or alkalinity. Jar tests should be conducted to determine the amounts of coagulants which will produce a zeta potential of -7 to -10 mV, and maintain the proper alkalinity. Various examples illustrated the applicability of zeta potential for determining treatment dosages. (Collins-FIRL)
W77-09908

ATOMIC ABSORPTION IN WATER AND WASTE WATER ANALYSIS,
Perkin-Elmer Corp., Lombard, Ill.
R. D. Ediger.

Water and Sewage Works, Reference Issue, p 112, 115-118, April, 1977. 4 fig.

Descriptors: *Pollutant identification, *Analytical techniques, *Water analysis, *Metals, Instrumentation, Equipment, Sulfates, Phosphates, Chlorides, Mercury, *Waste water treatment.
Identifiers: *Atomic absorption analysis.

Determination of metals in waste water by atomic absorption was reviewed. Direct analysis of about 65 elements is possible with this method. Sulfate, phosphate, and chloride may be indirectly determined. Standardized techniques for either major or trace levels are available for metals of interest in water quality analysis. Atomic absorption has the advantage of little interference as compared to other techniques. Interferences which do exist are most often chemical, matrix, ionization, and background adsorption. These are relatively easy to control. Solvent extraction is usually used when concentrations below the instrument range occur. This enhances the sensitivity of atomic absorption when the proper organic solvent is used. Flame atomization is most widely used, but has several drawbacks. The sample is inefficiently used, thus reducing the opportunity of sample light adsorption. The graphite furnace method has better sensitivity and detection limits. The hydride genera-

tion system is useful in determining very low levels of arsenic, selenium, bismuth, and antimony. Drawbacks of this method include limited applicability to the elements important in water analysis; greater sample manipulation is necessary than for the flame method. Its prime advantage is a price of about \$500 compared to over \$4,000 for the graphite furnace. Various flameless systems have been developed for mercury analysis. (Collins-FIRL)
W77-09909

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,

Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 5B.
W77-09915

CARBON ISOTOPIC STUDY OF THE FATE OF LANDFILL LEACHATE IN GROUNDWATER,
Indiana Univ., Bloomington. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W77-09917

SOUTH BEND'S INDUSTRIAL SURVEILLANCE WASTE WATER MONITORING PROGRAM,
South Bend Bureau of Wastewater, Ind.
J. M. Jeter, and R. S. Liggett.
Water and Sewage Works, Vol. 124, No. 5, p 74-80, May, 1977. 6 fig, 2 tab, 10 ref.

Descriptors: *Monitoring, *Industrial wastes, Water pollution sources, Regulation, Legislation, Water quality standards, Personnel, Cities, Treatment facilities, Equipment, Analysis, *Waste water treatment.
Identifiers: South Bend(IN).

The South Bend, Indiana, program for industrial surveillance and waste water monitoring was examined. The program consisted of industrial waste water characterization and treatment facility monitoring. Its objective was to develop a suitable management program. Program personnel and equipment requirements were discussed. A chemist and two technicians were employed full-time, with another chemist and technician available as needed. Automated sampling units, analytical equipment and glassware, as well as a vehicle and traffic equipment were requisitioned as essentials. The quality and quantity of industrial effluents were monitored. Treatment facilities were monitored to determine the impact of the added industrial loads on performance. Evaluation criteria for treatment plants were pH, suspended solids, BOD₅, COD, phosphate-phosphorus, fecal and total coliforms, and metals. Water quality parameters for river monitoring were pH, BOD₅, COD, DO, phosphate-phosphorus, temperature, fecal coliform, total metals, total cyanides, oil, and greases. The city has expanded its analytical capabilities. Carbon rod atomization and atomic absorption techniques were being refined to increase sensitivity for certain total metal parameters. Phenolics determination and oil finger-printing by gas chromatography were also being developed. Various required reporting procedures were described. (Collins-FIRL)
W77-09919

GROUNDWATER POLLUTION HAZARD NEAR SANITARY LANDFILLS ON THE GLACIATED PLAINS, NORTH DAKOTA - A STUDY OF THE LANGDON, NORTH DAKOTA SANITARY LANDFILL.
Geological Survey, Grand Forks, N. Dak.
For primary bibliographic entry see Field 5B.
W77-09925

GEOCHEMICAL CONTROLS ON TRACE ELEMENT CONCENTRATIONS IN NATURAL WATERS OF A PROPOSED COAL ASH LANDFILL SITE,
Kansas State Univ., Manhattan. Dept. of Geology.

For primary bibliographic entry see Field 5B.
W77-09928

TRANSMISSION SPECTROSCOPY EXAMINATIONS OF NATURAL WATERS-C. ULTRAVIOLET SPECTRAL CHARACTERISTICS OF THE TRANSITION FROM TERRESTRIAL HUMUS TO MARINE YELLOW SUBSTANCE.
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
M. Brown.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 309-317, May 1977. 5 fig, 1 tab, 24 ref.

Descriptors: *Pollutant identification, *Spectroscopy, *Sea water, *Humus, Laboratory tests, Sampling, Surveys, Salinity, Water types, Chemicals, Chemical properties, Microwaves, Oceanography.
Identifiers: *Transmission spectroscopy, *Baltic Sea.

The author defined a spectral slope value for ultraviolet absorption spectra of natural waters for use in a major study of spectral characteristics of Baltic waters. The results showed a steepening in the spectra as total absorption decreases, going from slightly saline waters of the northern Bothnian Bay to North Sea waters entering the Kattegat. The qualitative change is related to the selective loss of high molecular weight humic components of the yellow substance. The literature relating to spectral differences in molecular weight fractions of natural humus was reviewed. When spectral data are combined with salinity values, a categorization of water types is possible, giving Baltic surface, Baltic deep, and North Sea types. The various processes contributing to the differentiation were discussed, and an associated experiment examined the spectral effects of bacterial activity on marine humus. (Sims-ISWS)
W77-09945

INTERACTIONS BETWEEN ZINC AND SUSPENDED SEDIMENTS IN THE FRASER RIVER ESTUARY, BRITISH COLUMBIA.
British Columbia Univ., Vancouver. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5B.
W77-09949

ESTIMATION OF COMPONENTS OF SOIL CATION EXCHANGE CAPACITY FROM MEASUREMENTS OF SPECIFIC SURFACE AND ORGANIC MATTER.
University Coll., Dublin (Ireland). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09971

SAMPLING THE UNSATURATED ZONE OF IRRIGATED LANDS FOR RELIABLE ESTIMATES OF NITRATE CONCENTRATIONS.
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-09974

THE COCKFIELD AQUIFER IN MISSISSIPPI.
Geological Survey, Jackson, Miss. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-09991

ELEMENTS NEEDED IN DESIGN OF A GROUND-WATER-QUALITY MONITORING NETWORK IN THE HAWAIIAN ISLANDS.
Geological Survey, Honolulu, Hawaii. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-09995

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10000

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10001

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1975.
Geological Survey, Cheyenne, Wyo. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10002

ANNUAL WATER-RESOURCES REVIEW WHITE SANDS MISSILE RANGE, 1976 - A BASIC-DATA REPORT.
Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10005

WATER QUALITY PROGRAM OF THE U.S. GEOLOGICAL SURVEY.
Geological Survey, Reston, Va. Water Resources Div.
R. J. Pickering.
Water and Sewage Works, Vol 124, No 4, p 88-89, April 1977. 2 fig.

Descriptors: *Water quality, *Water resources, *Surface waters, *Groundwater, *Data collections, Reviews, Federal Government, State Governments, *Programs, Projects, Cooperatives, Costs, Water quality control, Water pollution sources, Water analysis, Chemical analysis, United States.

Responsible for assessing the nation's natural resources, the U.S. Geological Survey conducts research on the properties and behavior of water in all segments of the hydrologic cycle. Although it has no regulatory responsibility with respect to the nation's water resources, the Geological Survey gathers more data on their extent, availability and quality than any other U.S. agency. The Geological Survey's water-resources program is conducted by its Water Resources Division which maintains, in addition to its headquarters at the Geological Survey's National Center at Reston, Virginia, 4 regional and 46 district offices throughout the United States and its possessions as well as numerous subdistrict offices, field headquarters, and special project offices. Altogether, the Water Resources Division maintains about 240 field offices. Slightly more than half of the Geological Survey's water-quality work is conducted through its cooperative program with State and local agencies. This program consists of a wide variety of water-resources investigations that are supported by 50 percent federal funds and 50 percent State or local funds. The investigations, which are carried out almost entirely by personnel of the Water Resources Division's field offices, range from studies of the effect of landfills on groundwater quality to sophisticated models of the movement of pollutants in stream and groundwater systems. (Woodard-USGS)
W77-10006

WATER RESOURCES OF THE UMATILLA INDIAN RESERVATION, OREGON.
Geological Survey, Portland, Ore. Water Resources Div.
For primary bibliographic entry see Field 4A.

W77-10011

GEOHYDROLOGY OF MUSCATINE ISLAND, MUSCATINE COUNTY, IOWA.
Geological Survey, Iowa City, Iowa. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10012

1976 WATER-QUALITY DATA IN BEAR CREEK BASIN, MEDFORD, OREGON.
Geological Survey, Portland, Ore. Water Resources Div.
S. W. McKenzie, and L. A. Wittenberg.
Open-file report 77-90, January 1977. 44 p, 2 fig, 5 tab, 9 ref.

Descriptors: *Water quality, *Surface waters, *Irrigation canals, *Drainage systems, *Streamflow, Flow rates, Data collections, Sampling, Chemical analysis, Sediments, Monitoring, Sites, *Oregon, Water pollution sources, Agricultural runoff, Nutrients, Coliforms, Water temperature, Dissolved solids, Turbidity, Hydrogen ion concentration.
Identifiers: *Bear Creek basin(Southwestern Ore).

The U.S. Geological Survey, in cooperation with the Rogue Valley Council of Governments, is studying surface-water-quality problems and their causes in the Bear Creek basin of southwestern Oregon. Two specific areas of investigation include: measurements of the quality and quantity of water in the irrigation canals and drainage system and the diel (during a 24-hour period) variation of water-quality parameters in the main stem of Bear Creek. The irrigation and drainage study involves 25 sites in canals and natural drainageways. One hundred thirty-three samples were collected for analysis, and discharge was determined at the time of collection. The diel study includes six sites on Bear Creek. (Woodard-USGS)
W77-10015

OIL SPILL IDENTIFICATION SYSTEM.
Coast Guard Research and Development Center, Groton, Conn.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 803, Price codes: A02 in paper copy, A01 in microfiche. Interim Report No CG-D-41-75, October 1974. 53 p, 24 fig, 8 tab, 8 append.

Descriptors: *Oil spills, *Pollutant identification, *Water pollution sources, *Oil pollution, Analytical techniques, *Waste identification, Oil wastes.

The U.S. Coast Guard Research and Development Center has developed a system for forensic identification and classification of oil spills. This system is comprised of procedures for sampling, sample transmittal and four independent analytical techniques: infrared and fluorescence spectroscopy, gas chromatography, and thin-layer chromatography. Each analytical technique has been developed to a high degree of reliability and its effectiveness tested under controlled conditions (simulated spills and weathering). The methods were tested in ten simulated spills involving 63 samples. The merits of the identification system have been demonstrated in thirty-eight real world spill cases. In every case, all analytical methods agreed on one source as responsible for the oil spill. In all verifiable cases (approx. 25%) the analytical methods identified the true source. (Sinha-OEIS)
W77-10024

MERCURY DETECTION SIMPLIFIED.
Council for Scientific and Industrial Research, Pretoria (South Africa).
Scientiae, Vol. 16, No. 2, p 18, 1975. 1 fig.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Descriptors: *Pollutant identification, *Mercury, Heavy metals, Sediments, Environment, Industrial water, Water quality, Microwaves, Sampling, Analytical procedures.

Mercury is one of the most dangerous heavy metals in the environment. Because fish and many other organisms have the ability to accumulate this metal, it can cause poisoning even when concentrations detectable in the surrounding environment are extremely low. The monitoring of mercury is essential in any environmental program. A very sensitive method of detection is required, but because of the number and variety of samples to be tested, it should also be simple and practicable. The new method developed by the National Physical Research Laboratory of the Council for Scientific and Industrial Research (CSIR), which uses microwave discharge, has lowered the required concentration of mercury by several orders of magnitude - from 10 to the 9th power to 10 to the 17th power - so that a sample of only 100ml is now sufficient for a test. (So African Water Info Center)

W77-10084

PARAMETERS WHICH INFLUENCE THE ORGANIC CARBON DETERMINATION IN WATER

National Inst. for Water Research, Pretoria (South Africa).
R. A. Van Steenderen.
Water SA, Vol. 2, No. 4, p 156-159, October 1976. 2 fig, 4 tab, 10 ref.

Descriptors: *Pollutant identification, *Carbon, Sampling, Water analysis, Sample storage, Dissolved solids, Membrane filters, Filtration, Retention, Acidification, Temperature effect, Statistical analysis, Sewage effluents.
Identifiers: *Organic carbon.

An automated Beckman TOC analyser Model 915 was used to study the parameters influencing the organic carbon content of a water sample. Samples must be stored in all glass sealed containers and analysed without delay, or preserved with silver sulphate solution and stored at 4°C. DOC samples must be filtered through a 0.45 microgram membrane filter. Acidifying of water samples to remove inorganic carbon is not recommended. (So African Water Info Center)

W77-10092

MICROCYSTIS TOXINS: ISOLATION, IDENTIFICATION, IMPLICATIONS

National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, W. E. Scott, and M. J. Pitout.
Water SA, Vol. 2, No. 4, p 160-162, October 1976. 3 fig, 1 tab, 12 ref.

Descriptors: *Pollutant identification, *Algal toxins, *Bioassay, Chromatography, Electrophoresis, Eutrophication, Peptides.
Identifiers: Hartbeespoort Dam, South Africa, Microcystis aeruginosa.

The nature of Microcystis toxin from Hartbeespoort Dam was reinvestigated. Column and thin layer chromatography and electrophoresis procedures indicated the presence of two toxins, both peptides. The results indicate that the suggestion of Louw (1950) that the toxin of M. toxica is an alkaloid, was erroneous and that the local toxins are similar to the Canadian ones. Since the local toxins can cause the death of a wide variety of animals, produce irreversible liver damage at subacute concentrations, and may not be removed by conventional water treatment processes, these toxins are presently regarded as potential health hazards. Eutrophication problems in South African impoundments are increasing and further research on the nature of the toxins and the conditions under which they are produced are in progress. (So African Water Info Center)

W77-10093

DEHYDRATION OF MARINE ZOOLOGICAL MATERIAL - VOLATILITY OF METABOLISED SELENIUM AT 105-120°C

Department of Industries, Cape Town (South Africa). Div. of Sea Fisheries.
H. O. Fourie, and M. Peisach.
South African Journal of Science, Vol. 72, No. 11, p 349, November 1976. 1 fig, 3 ref.

Descriptors: *Pollutant identification, *Oysters, Cadmium, Lead, Salts, *Dehydration, Marine animals, Trace elements, Heavy metals, *Bioindicators, Temperature effect, Accuracy, Evaluation, Radioisotopes, Volatility.
Identifiers: Crassostrea gigas, South Africa, *Selenium.

The oyster *Crassostrea gigas* is a known indicator species useful for measuring trace element concentrations in the marine environment. Oyster flesh, with a water content of 90% by mass, is generally oven-fried at low temperatures or freeze-dried, on the assumption that accumulated trace metals retain their inorganic nature and are analysed as inorganic salts, for determining recovery yields. Losses under experimental conditions were considered unlikely. Recent investigations showed that experimental conditions were considered unlikely. Recent investigations showed that losses of ingested radio-active inorganic salts did occur during dehydration, thus implying a change in chemical form during the accumulation process. The reported losses were statistically significant for Se, Cd and Pb. Evidence is reported of the recovery of volatile Se. Similar studies on Cd and Pb will be undertaken. (So African Water Info Center)

W77-10095

5B. Sources Of Pollution

AN ENERGY BALANCE FOR ALGAL POPULATIONS IN LIGHT-LIMITING CONDITIONS

For primary bibliographic entry see Field 5C.
W77-09609

THE PHYSICO-CHEMICAL LIMNOLOGY OF THE MWENDA RIVER MOUTH, LAKE KARIBA,
Rhodesia Univ., Salisbury. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09614

THE ROLE OF HUMIC ACIDS IN THE UPTAKE AND RELEASE OF MERCURY BY FRESHWATER SEDIMENTS,
R. W. Miller.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2082-2086, 1975. 1 fig, 4 tab, 9 ref. EPA R-800427.

Descriptors: *Humic acids, *Mercury, Adsorption, Sedimentation, Organic matter, *Bottom sediments, Dispersion, Movement, Freshwater, *Sediments, Waste water treatment.

Investigations of the removal of mercury from freshwater ecosystems by sedimentary and suspended particulate shows that a cycle of mercury uptake and release involving humic acid occurs in whole sediments under laboratory conditions. Since mercury levels seldom exceed 0.1 ppm in natural waters, almost total mercury removal occurs and only the rate of uptake by the sediments varies. The great difference noted in the mercury uptake rate from water between core tubes and shaken sediments is due to the greater surface area exposed in disturbed sediments, but in most natural systems it may take days or weeks for total removal of mercury from the water. After deposition in the sediments, part of the mercury is associated with humic acid. The amount complexation and reduction processes are controlled by the ratio of humic acid to mercury, as at low humic

acid levels the reduction process is limited. As the humic acid concentration increases, the rate of elemental mercury increases, but this is offset by a greater amount of complex formation between humic acid and mercury. When the humic acid is in great excess, all the mercury is strongly bound and is unable to be released. (Auen-Wisconsin)
W77-09615

THE CONSEQUENCES OF IMPOUNDMENT ON AN ARCTIC CHAR LAKE SYSTEM. AN ANALYSIS BY SIMULATION MODELLING,

P. E. Grotnes.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2529-2537, 1975. 4 fig, 2 tab, 17 ref.

Descriptors: *Model studies, *Impoundments, *Fish, Simulation analysis, Fishing, Fish reproduction, Fish diets, Littoral, Fish food organisms, Fish populations, Biomass, Aquatic environment, Growth stages, Deep water, Lake trout, Subarctic, Salmonids.
Identifiers: Skjomen lake system (Scandinavia).

A digital simulation model of the quasiparallel discrete events sequencing type was developed in order to study the compounded effects of impoundments on fish of the pelagic block and fish of the littoral block. The Skjomen lake system, a char lake system of three subarctic, oligotrophic lakes, was used as a reference. Results indicate that the model was not conclusive as to the most important factor. Food variations gave a response in biomass variation, but the biomass increase was not accompanied by a comparable increase in the catchable portion, and conspicuous increases in catch and sizes of fish caught would not result from a food increase alone. The biomass decreased most severely due to the loss of reproduction for a few years even when the food supply was constant. The catchable biomass was at its largest only when reproduction was reduced. Influence of a 20% annual reduction by fishing of the larger sized individuals seemed to be less important than the reproduction and food level factors. The model predicted that the increases in catches in the first years after the impoundment was a compounded result of a real increase in the fish biomass and increasingly younger pre-impoundment year classes reaching catchable weight. The reduction in catch first occurred when all year classes born before impoundment reached catchable fish sizes. (Luedtke-Wisconsin)
W77-09616

RATES OF TRANSPORT OF TOTAL PHOSPHORUS AND TOTAL NITROGEN IN MACKENZIE AND YUKON RIVER WATERSHEDS, N.W.T. AND Y.T., CANADA,
For primary bibliographic entry see Field 5C.
W77-09617

INTENSIVE LARGE CITY INFLUENCE ON REED-BANKS, (IN GERMAN),
Technische Universitaet, Berlin (West Germany). Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W77-09621

EXPERIMENTS ON THE EFFECTS OF INORGANIC ENRICHMENT OF RIVERS ON PERIPHYTON PRIMARY PRODUCTION,
For primary bibliographic entry see Field 5C.
W77-09625

GROWTH AND PHOTOSYNTHESIS DURING THE FORMATION OF A BENTHIC ALGAL COMMUNITY,
For primary bibliographic entry see Field 5C.
W77-09627

DEGRADATION OF A NONIONIC SURFACTANT IN SOILS AND PEAT, California Univ., Riverside. Dept. of Soil Physics. N. Valoras, J. Letey, J. P. Martin, and J. Osborn. Soil Science Society of America Journal, Vol. 40, No. 1, p 60-63, January-February 1976. 3 fig, 4 tab, 7 ref. OWRT B-141-CAL(13).

Descriptors: *Surfactants, *Soil water movement, Soils, Soil investigations, Soil properties, *Peat, Adsorption, Soil moisture, Organic matter, Water pollution, Water quality.
Identifiers: *Surfactant degradation(Soils).

Nonionic surfactants are used to improve water movement into water-repellent soils. The effective longevity of treatment and potential water pollution are affected by surfactant degradation. Degradation of C-14-labeled Soil Penetrant 3685, a nonionic surfactant, was measured in incubation studies in the laboratory. Three soils and one peat, numerous surfactant concentrations, and two soil-moisture levels were used as experimental variables. Plots of degradation percentage versus time produced 'S' type curves. Increasing the concentration increased the lag period prior to most rapid degradation. The most rapid and highest percentage of degradation were generally associated with soil materials having the lowest adsorptive capacity for the surfactant. From about 75 to 85 % of the C-14 was evolved as (C-14) O₂ in 1 year for the most favorable conditions for degradation. Degradation rate was decreased by decreasing the soil-moisture content. Degradation of soil organic matter was not greatly affected by surfactant applications—< about 10,000 ppm, but progressively decreased with higher surfactant concentrations. (Skogerboe-Colorado State)
W77-09638

EFFECT OF PRETREATMENT ON LOSS OF NITROGEN-15 LABELLED FERTILIZER NITROGEN FROM WATERLOGGED SOIL DURING INCUBATION, Prairie View A and M Coll., Tex. For primary bibliographic entry see Field 2G.
W77-09643

PICLORAM DEGRADATION IN SOILS AS INFLUENCED BY SOIL WATER CONTENT AND TEMPERATURE, Agricultural Research Service, Fort Collins, Colo. W. D. Guenzi, and W. E. Beard. Journal of Environmental Quality, Vol. 5, No. 2, p 189-192, April-June 1976. 2 fig, 5 tab, 16 ref.

Descriptors: *Pesticides, *Herbicides, Laboratory tests, Temperature, Soil investigations, Soils, Field capacity, *Pesticide residues, *Microbial degradation, Soil water, Water pollution sources.
Identifiers: *Picloram degradation(Soils).

A laboratory experiment was designed to determine the effect of temperature and alternating incubations at field capacity and during drying periods on the degradation of picloram in five soils. Picloram was added at a rate of 10 ppm, and degradation was measured by (C-14) O₂ evolution resulting from the cleavage of the labeled carboxyl carbon. Picloram degraded very little at 5C and increased only slightly up to 25C. Three soils were highest in degradation rates at 30C while two soils were highest at 50C. Picloram degradation rates during 20-day incubation periods at field capacity, interrupted with 16-day drying cycles, varied among soils and decreased after each successive drying cycle at 30 and 50C, except for one soil at 50C. The degradation rate decreased gradually as water content decreased from field capacity (approximately 0.33 bar) to 15 bars tension, and ceased after the soils were air dried. (See also W74-02383) (Skogerboe-Colorado State University).
W77-09644

DISTRIBUTION OF PLUTONIUM IN TRINITY SOILS AFTER 28 YEARS, Los Alamos Scientific Lab., N. Mex. J. W. Nyhan, F. R. Miera Jr., and R. E. Neher. Journal of Environmental Quality, Vol. 5, No. 4, p 431-437, October-December 1976. 6 fig, 4 tab, 22 ref.

Descriptors: Soils, *Soil investigations, Nuclear wastes, Nuclear explosions, Sampling, Soil horizons, Soil profiles, Carbonates, *Distribution, *Path of pollutants, Water pollution sources.
Identifiers: *Trinity soils, *Plutonium.

The soils of four intensive study areas located along the fallout pathway of Trinity, the first nuclear detonation, were sampled to determine soil plutonium concentrations as a function of distance from Ground Zero and soil depth. About half of the 239,240Pu in Trinity soils was found at the 5-20 cm depth in 1973 compared to total plutonium inventories found only in the upper 5 cm of soil about 20 years ago. Soil plutonium concentrations of samples collected at the same depth of each study area generally exhibited coefficients of variation > 1.2. Maximum penetration depths of 239,240Pu into Trinity Site soils were related to the presence of subsoil horizons containing carbonate accumulations and the maximum extent of rainwater penetration into these soil profiles. (Skogerboe-Colorado State)
W77-09647

PREDICTING 2,4,5-T MOVEMENT IN SOIL COLUMNS, New Mexico Agricultural Experiment Station, University Park. G. A. O'Connor, M. Th. Van Genuchten, and P. J. Wierenga. Journal of Environmental Quality, Vol. 5, No. 4, p 375-378, October-December 1976. 8 fig, 1 tab, 9 ref.

Descriptors: *Model studies, Effluents, *Tritium, Soils, Soil investigations, Forecasting, Adsorption, *Pesticides, Herbicides, *2,4,5-T, Soil water movement, *Path of pollutants, Water pollution sources.
Identifiers: Soil columns, Solute transport, Breakthrough curves.

A solute model developed by van Genuchten and Wierenga was used to calculate 2,4,5-T effluent data from soil columns. The model had been previously shown to adequately predict effluent data given model parameters curve fit to a portion of the effluent curve. The present work shows that 2,4,5-T effluent curves may be adequately predicted without prior knowledge of the effluent curves for a particular soil column given: (1) model parameters derived from 2,4,5-T effluent curves for other soil columns, or (2) model parameters obtained from tritium effluent curves for the same columns. The data suggest that once the physical model parameters have been characterized for a soil, reasonable predictions of 2,4,5-T (and perhaps other solutes) transport can be made given the adsorption coefficient for the solute. (Skogerboe-Colorado State)
W77-09649

SIMULTANEOUS TRANSPORT OF NITRATE AND GASEOUS DENITRIFICATION PRODUCTS IN SOIL, California Univ., Davis. Dept. of Land, Air and Water Resources. D. E. Rolston, and M. A. Marino. Soil Science Society of America Journal, Vol. 40, No. 6, p 860-865, November-December 1976. 5 fig, 2 tab, 17 ref.

Descriptors: Fertilizer, Fertilization, *Nitrates, *Denitrification, Soil properties, Soil investigations, Soil water, *Soil water movement, Leaching, Path of pollutants, Water pollution sources.

A pulse of NO₃(-) fertilizer tagged with N-15 was applied to 100 cm long Yolo loam (Typic Xerorthents) topsoil and subsoil columns maintained uniformly unsaturated at soil-water pressure heads between -20 and -140 cm of water at soil-water fluxes between 1.0 and 0.1 cm day⁻¹. Nitrate, molecular nitrogen, and nitrous oxide from the applied fertilizer were measured as a function of soil depth and time until the NO₃(-) pulse eluted from the column. An analytical solution describing the transport and transformation of NO₃(-) was used to determine values for the first-order denitrification rate constants within the columns. A numerical solution of the coupled equations for transport and transformation of NO₃(-) and diffusion of the gaseous denitrification products was compared with measured N₂ and N₂O concentration profiles within columns. The gaseous concentration profiles were very much dependent upon values of the denitrification rate constant and the soil gaseous diffusion coefficient. Values of the soil gaseous diffusion coefficient, more than an order of magnitude smaller than those values measured in the upper part of the column, were required to approximately fit the numerical solution to the measured gas concentration profiles. (Skogerboe-Colorado State)
W77-09653

EFFECTS OF BORON AND NITROGEN ON GRAIN YIELD AND BORON AND NITROGEN CONCENTRATIONS OF BARLEY AND WHEAT, Department of Agriculture, Charlottetown (Prince Edward Island). Research Station. For primary bibliographic entry see Field 3F.
W77-09655

INFLUENCE OF IONIC STRENGTH AND INORGANIC COMPLEX FORMATION ON THE SORPTION OF TRACE AMOUNTS OF CD BY MONTMORILLONITE, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. J. Garcia-Miragayma, and A. L. Page. Soil Science Society of America Journal, Vol. 40, No. 5, p 658-663, September-October 1976. 5 fig, 3 tab, 20 ref.

Descriptors: *Cadmium, Sorption, *Montmorillonite, *Clays, Soils, Soil investigations, *Soil chemistry, Heavy metals, *Trace elements, *Ions, Sorption, Soil surfaces.

Cadmium sorption by montmorillonite from solutions in the 15 to 120 ppb range was studied in the presence of increasing concentrations of NaClO₄, NaCl, and Na₂SO₄ solutions. The ionic strengths ranged from 0.01 to 1.00. Increasing ionic strengths decreased the amount of Cd sorbed on the clay surfaces. The percentage sorbed decreased from about 90% for I=0.01 to about 50% for I=1.00 in the ClO₄ systems. The sorption of Cd in the chloride system was in the range between 25 to 50% less than the ClO₄ systems for the same ionic strength. This was attributed to the presence of uncharged and negatively charged complexes of Cd and Cl ligands. This fact has some implications, especially in arid zone soils where high Cl concentrations in soil solution are not unusual; there, Cd will behave mainly as a neutral species (CdCl₂(0)) and as an anion (CdCl₃(-) and CdCl₄(2-)), rather than as a cation (Cd(2+)). The SO₄ systems showed a moderate decrease in the amount of Cd sorbed with respect to the ClO₄ systems for the same salt concentrations. This observation was interpreted as due to the presence of a fraction of Cd in solution as the CdSO₄(0) species. (Skogerboe-Colorado State)
W77-09658

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Descriptors: *Pollutant identification, *Mercury, Heavy metals, Sediments, Environment, Industrial water, Water quality, Microwaves, Sampling, Analytical procedures.

Mercury is one of the most dangerous heavy metals in the environment. Because fish and many other organisms have the ability to accumulate this metal, it can cause poisoning even when concentrations detectable in the surrounding environment are extremely low. The monitoring of mercury is essential in any environmental program. A very sensitive method of detection is required, but because of the number and variety of samples to be tested, it should also be simple and practicable. The new method developed by the National Physical Research Laboratory of the Council for Scientific and Industrial Research (CSIR), which uses microwave discharge, has lowered the required concentration of mercury by several orders of magnitude - from 10 to the 9th power to 10 to the 17th power - so that a sample of only 100nl is now sufficient for a test. (So African Water Info Center) W77-10084

PARAMETERS WHICH INFLUENCE THE ORGANIC CARBON DETERMINATION IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
R. A. Van Steenderen.
Water SA, Vol. 2, No. 4, p 156-159, October 1976. 2 fig, 4 tab, 10 ref.

Descriptors: *Pollutant identification, *Carbon, Sampling, Water analysis, Sample storage, Dissolved solids, Membrane filters, Filtration, Retention, Acidification, Temperature effect, Statistical analysis, Sewage effluents.
Identifiers: *Organic carbon.

An automated Beckman TOC analyser Model 915 was used to study the parameters influencing the organic carbon content of a water sample. Samples must be stored in all glass sealed containers and analysed without delay, or preserved with silver sulphate solution and stored at 4°C. DOC samples must be filtered through a 0.45 microgram membrane filter. Acidifying of water samples to remove inorganic carbon is not recommended. (So African Water Info Center) W77-10092

MICROCYSTIS TOXINS: ISOLATION, IDENTIFICATION, IMPLICATIONS,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, W. E. Scott, and M. J. Pitout.
Water SA, Vol. 2, No. 4, p 160-162, October 1976. 3 fig, 1 tab, 12 ref.

Descriptors: *Pollutant identification, *Algal toxins, *Bioassay, Chromatography, Electrophoresis, Eutrophication, Peptides.
Identifiers: Hartbeespoort Dam, South Africa, Microcystis aeruginosa.

The nature of Microcystis toxin from Hartbeespoort Dam was reinvestigated. Column and thin layer chromatography and electrophoresis procedures indicated the presence of two toxins, both peptides. The results indicate that the suggestion of Louw (1950) that the toxin of *M. toxica* is an alkaloid, was erroneous and that the local toxins are similar to the Canadian ones. Since the local toxins can cause the death of a wide variety of animals, produce irreversible liver damage at subacute concentrations, and may not be removed by conventional water treatment processes, these toxins are presently regarded as potential health hazards. Eutrophication problems in South African impoundments are increasing and further research on the nature of the toxins and the conditions under which they are produced are in progress. (So African Water Info Center) W77-10093

DEHYDRATION OF MARINE ZOOLOGICAL MATERIAL - VOLATILITY OF METABOLISED SELENIUM AT 105-120°C,
Department of Industries, Cape Town (South Africa). Div. of Sea Fisheries.
H. O. Fourie, and M. Peisach.
South African Journal of Science, Vol. 72, No. 11, p 349, November 1976. 1 fig, 3 ref.

Descriptors: *Pollutant identification, *Oysters, Cadmium, Lead, Salts, *Dehydration, Marine animals, Trace elements, Heavy metals, *Bioindicators, Temperature effect, Accuracy, Evaluation, Radioisotopes, Volatility.
Identifiers: Crassostrea gigas, South Africa, *Selenium.

The oyster *Crassostrea gigas* is a known indicator species useful for measuring trace element concentrations in the marine environment. Oyster flesh, with a water content of 90% by mass, is generally oven-fried at low temperatures or freeze-dried, on the assumption that accumulated trace metals retain their inorganic nature and are analysed as inorganic salts, for determining recovery yields. Losses under experimental conditions were considered unlikely. Recent investigations showed that experimental conditions were considered unlikely. Recent investigations showed that losses of ingested radio-active inorganic salts did occur during dehydration, thus implying a change in chemical form during the accumulation process. The reported losses were statistically significant for Se, Cd and Pb. Evidence is reported of the recovery of volatile Se. Similar studies on Cd and Pb will be undertaken. (So African Water Info Center) W77-10095

5B. Sources Of Pollution

AN ENERGY BALANCE FOR ALGAL POPULATIONS IN LIGHT-LIMITING CONDITIONS,
For primary bibliographic entry see Field 5C.
W77-09609

THE PHYSICO-CHEMICAL LIMNOLOGY OF THE KWENDA RIVER MOUTH, LAKE KARIBA,
Rhodesia Univ., Salisbury. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09614

THE ROLE OF HUMIC ACIDS IN THE UPTAKE AND RELEASE OF MERCURY BY FRESHWATER SEDIMENTS,
R. W. Miller.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2082-2086, 1975. 1 fig, 4 tab, 9 ref. EPA R-800427.

Descriptors: *Humic acids, *Mercury, Adsorption, Sedimentation, Organic matter, *Bottom sediments, Dispersion, Movement, Freshwater, *Sediments, Waste water treatment.

Investigations of the removal of mercury from freshwater ecosystems by sedimentary and suspended particulate shows that a cycle of mercury uptake and release involving humic acid occurs in whole sediments under laboratory conditions. Since mercury levels seldom exceed 0.1 ppm in natural waters, almost total mercury removal occurs and only the rate of uptake by the sediments varies. The great difference noted in the mercury uptake rate from water between core tubes and shaken sediments is due to the greater surface area exposed in disturbed sediments, but in most natural systems it may take days or weeks for total removal of mercury from the water. After deposition in the sediments, part of the mercury is associated with humic acid. The amount complexation and reduction processes are controlled by the ratio of humic acid to mercury, as at low humic

acid levels the reduction process is limited. As the humic acid concentration increases, the rate of elemental mercury increases, but this is offset by a greater amount of complex formation between humic acid and mercury. When the humic acid is in great excess, all the mercury is strongly bound and is unable to be released. (Auen-Wisconsin) W77-09615

THE CONSEQUENCES OF IMPOUNDMENT ON AN ARCTIC CHAR LAKE SYSTEM. AN ANALYSIS BY SIMULATION MODELLING,
P. E. Grotnes.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2529-2537, 1975. 4 fig, 2 tab, 17 ref.

Descriptors: *Model studies, *Impoundments, *Fish, Simulation analysis, Fishing, Fish reproduction, Fish diets, Littoral, Fish food organisms, Fish populations, Biomass, Aquatic environment, Growth stages, Deep water, Lake trout, Subarctic, Salmonids.
Identifiers: Skjomen lake system (Scandinavia).

A digital simulation model of the quasiparallel discrete events sequencing type was developed in order to study the compounded effects of impoundments on fish of the pelagic block and fish of the littoral block. The Skjomen lake system, a char lake system of three subarctic, oligotrophic lakes, was used as a reference. Results indicate that the model was not conclusive as to the most important factor. Food variations gave a response in biomass variation, but the biomass increase was not accompanied by a comparable increase in the catchable portion, and conspicuous increases in catch and sizes of fish caught would not result from a food increase alone. The biomass decreased most severely due to the loss of reproduction for a few years even when the food supply was constant. The catchable biomass was at its largest only when reproduction was reduced. Influence of a 20% annual reduction by fishing of the larger sized individuals seemed to be less important than the reproduction and food level factors. The model predicted that the increases in catches in the first years after the impoundment was a compounded result of a real increase in the fish biomass and increasingly younger pre-impoundment year classes reaching catchable weight. The reduction in catch first occurred when all year classes born before impoundment reached catchable fish sizes. (Luedtke-Wisconsin) W77-09616

RATES OF TRANSPORT OF TOTAL PHOSPHORUS AND TOTAL NITROGEN IN MACKENZIE AND YUKON RIVER WATERSHEDS, N.W.T. AND Y.T., CANADA,
For primary bibliographic entry see Field 5C.
W77-09617

INTENSIVE LARGE CITY INFLUENCE ON REED-BANKS, (IN GERMAN),
Technische Universitaet, Berlin (West Germany). Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W77-09621

EXPERIMENTS ON THE EFFECTS OF INORGANIC ENRICHMENT OF RIVERS ON PERIPHYTON PRIMARY PRODUCTION,
For primary bibliographic entry see Field 5C.
W77-09625

GROWTH AND PHOTOSYNTHESIS DURING THE FORMATION OF A BENTHIC ALGAL COMMUNITY,
For primary bibliographic entry see Field 5C.
W77-09627

DEGRADATION OF A NONIONIC SURFACTANT IN SOILS AND PEAT, California Univ., Riverside. Dept. of Soil Physics. N. Valaras, J. Letey, J. P. Martin, and J. Osborn. Soil Science Society of America Journal, Vol. 40, No. 1, p 60-63, January-February 1976. 3 fig, 4 tab, 7 ref. OWRT B-141-CAL(13).

Descriptors: *Surfactants, *Soil water movement, Soils, Soil investigations, Soil properties, *Peat, Adsorption, Soil moisture, Organic matter, Water pollution, Water quality.
Identifiers: *Surfactant degradation(Soils).

Nonionic surfactants are used to improve water movement into water-repellent soils. The effective longevity of treatment and potential water pollution are affected by surfactant degradation. Degradation of C-14-labeled Soil Penetrant 3685, a nonionic surfactant, was measured in incubation studies in the laboratory. Three soils and one peat, numerous surfactant concentrations, and two soil-moisture levels were used as experimental variables. Plots of degradation percentage versus time produced 'S' type curves. Increasing the concentration increased the lag period prior to most rapid degradation. The most rapid and highest percentage of degradation were generally associated with soil materials having the lowest adsorptive capacity for the surfactant. From about 75 to 85 % of the C-14 was evolved as (C-14) O₂ in 1 year for the most favorable conditions for degradation. Degradation rate was decreased by decreasing the soil-moisture content. Degradation of soil organic matter was not greatly affected by surfactant applications—< about 10,000 ppm, but progressively decreased with higher surfactant concentrations. (Skogerboe-Colorado State)
W77-09638

EFFECT OF PRETREATMENT ON LOSS OF NITROGEN-15-LABELLED FERTILIZER NITROGEN FROM WATERLOGGED SOIL DURING INCUBATION, Prairie View A and M Coll., Tex.
For primary bibliographic entry see Field 2G.
W77-09643

PICLORAM DEGRADATION IN SOILS AS INFLUENCED BY SOIL WATER CONTENT AND TEMPERATURE, Agricultural Research Service, Fort Collins, Colo. W. D. Guenzi, and W. E. Beard. Journal of Environmental Quality, Vol. 5, No. 2, p 189-192, April-June 1976. 2 fig, 5 tab, 16 ref.

Descriptors: *Pesticides, *Herbicides, Laboratory tests, Temperature, Soil investigations, Soils, Field capacity, *Pesticide residues, *Microbial degradation, Soil water, Water pollution sources.
Identifiers: *Picloram degradation(Soils).

A laboratory experiment was designed to determine the effect of temperature and alternating incubations at field capacity and during drying periods on the degradation of picloram in five soils. Picloram was added at a rate of 10 ppm, and degradation was measured by (C-14) O₂ evolution resulting from the cleavage of the labeled carboxyl carbon. Picloram degraded very little at 5°C and increased only slightly up to 25°C. Three soils were highest in degradation rates at 30°C while two soils were highest at 50°C. Picloram degradation rates during 20-day incubation periods at field capacity, interrupted with 16-day drying cycles, varied among soils and decreased after each successive drying cycle at 30 and 50°C, except for one soil at 50°C. The degradation rate decreased gradually as water content decreased from field capacity (approximately 0.33 bar) to 15 bars tension, and ceased after the soils were air dried. (See also W74-02383) (Skogerboe-Colorado State University).
W77-09644

DISTRIBUTION OF PLUTONIUM IN TRINITY SOILS AFTER 28 YEARS, Los Alamos Scientific Lab., N. Mex. J. W. Nyhan, F. R. Miera Jr., and R. E. Neher. Journal of Environmental Quality, Vol. 5, No. 4, p 431-437, October-December 1976. 6 fig, 4 tab, 22 ref.

Descriptors: Soils, *Soil investigations, Nuclear wastes, Nuclear explosions, Sampling, Soil horizons, Soil profiles, Carbonates, *Distribution, *Path of pollutants, Water pollution sources.
Identifiers: *Trinity soils, *Plutonium.

The soils of four intensive study areas located along the fallout pathway of Trinity, the first nuclear detonation, were sampled to determine soil plutonium concentrations as a function of distance from Ground Zero and soil depth. About half of the 239,240Pu in Trinity soils was found at the 5-20 cm depth in 1973 compared to total plutonium inventories found only in the upper 5 cm of soil about 20 years ago. Soil plutonium concentrations of samples collected at the same depth of each study area generally exhibited coefficients of variation > 1.2. Maximum penetration depths of 239,240Pu into Trinity Site soils were related to the presence of subsoil horizons containing carbonate accumulations and the maximum extent of rainwater penetration into these soil profiles. (Skogerboe-Colorado State)
W77-09647

PREDICTING 2,4,5-T MOVEMENT IN SOIL COLUMNS, New Mexico Agricultural Experiment Station, University Park. G. A. O'Connor, M. Th. Van Genuchten, and P. J. Wierenga. Journal of Environmental Quality, Vol. 5, No. 4, p 375-378, October-December 1976. 8 fig, 1 tab, 9 ref.

Descriptors: *Model studies, Effluents, *Tritium, Soils, Soil investigations, Forecasting, Adsorption, *Pesticides, Herbicides, *2,4,5-T, Soil water movement, *Path of pollutants, Water pollution sources.
Identifiers: Soil columns, Solute transport, Breakthrough curves.

A solute model developed by van Genuchten and Wierenga was used to calculate 2,4,5-T effluent data from soil columns. The model had been previously shown to adequately predict effluent data given model parameters curve fit to a portion of the effluent curve. The present work shows that 2,4,5-T effluent curves may be adequately predicted without prior knowledge of the effluent curves for a particular soil column given: (1) model parameters derived from 2,4,5-T effluent curves for other soil columns, or (2) model parameters obtained from tritium effluent curves for the same columns. The data suggest that once the physical model parameters have been characterized for a soil, reasonable predictions of 2,4,5-T (and perhaps other solutes) transport can be made given the adsorption coefficient for the solute. (Skogerboe-Colorado State)
W77-09649

SIMULTANEOUS TRANSPORT OF NITRATE AND GASEOUS DENITRIFICATION PRODUCTS IN SOIL, California Univ., Davis. Dept. of Land, Air and Water Resources. D. E. Rolston, and M. A. Marino. Soil Science Society of America Journal, Vol. 40, No. 6, p 860-865, November-December 1976. 5 fig, 2 tab, 17 ref.

Descriptors: Fertilizer, Fertilization, *Nitrates, *Denitrification, Soil properties, Soil investigations, Soil water, *Soil water movement, Leaching, Path of pollutants, Water pollution sources.

A pulse of NO₃(-) fertilizer tagged with N-15 was applied to 100 cm long Yolo loam (Typic Xerorthents) topsoil and subsoil columns maintained uniformly unsaturated at soil-water pressure heads between -20 and -140 cm of water at soil-water fluxes between 1.0 and 0.1 cm day⁻¹(l). Nitrate, molecular nitrogen, and nitrous oxide from the applied fertilizer were measured as a function of soil depth and time until the NO₃(-) pulse eluted from the column. An analytical solution describing the transport and transformation of NO₃(-) was used to determine values for the first-order denitrification rate constants within the columns. A numerical solution of the coupled equations for transport and transformation of NO₃(-) and diffusion of the gaseous denitrification products was compared with measured N₂ and N₂O concentration profiles within columns. The gaseous concentration profiles were very much dependent upon values of the denitrification rate constant and the soil gaseous diffusion coefficient. Values of the soil gaseous diffusion coefficient, more than an order of magnitude smaller than those values measured in the upper part of the column, were required to approximately fit the numerical solution to the measured gas concentration profiles. (Skogerboe-Colorado State)
W77-09653

EFFECTS OF BORON AND NITROGEN ON GRAIN YIELD AND BORON AND NITROGEN CONCENTRATIONS OF BARLEY AND WHEAT, Department of Agriculture, Charlottetown (Prince Edward Island). Research Station.
For primary bibliographic entry see Field 3F.
W77-09655

INFLUENCE OF IONIC STRENGTH AND INORGANIC COMPLEX FORMATION ON THE SORPTION OF TRACE AMOUNTS OF CD BY MONTMORILLONITE, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. J. Garcia-Miragayma, and A. L. Page. Soil Science Society of America Journal, Vol. 40, No. 5, p 658-663, September-October 1976. 5 fig, 3 tab, 20 ref.

Descriptors: *Cadmium, Sorption, *Montmorillonite, *Clays, Soils, Soil investigations, *Soil chemistry, Heavy metals, *Trace elements, *Ions, Sorption, Soil surfaces.

Cadmium sorption by montmorillonite from solutions in the 15 to 120 ppb range was studied in the presence of increasing concentrations of NaClO₄, NaCl, and Na₂SO₄ solutions. The ionic strengths ranged from 0.01 to 1.00. Increasing ionic strengths decreased the amount of Cd sorbed on the clay surfaces. The percentage sorbed decreased from about 90% for I=0.01 to about 50% for I=1.00 in the ClO₄ systems. The sorption of Cd in the chloride system was in the range between 25 to 50% less than the ClO₄ systems for the same ionic strength. This was attributed to the presence of uncharged and negatively charged complexes of Cd and Cl ligands. This fact has some implications, especially in arid zone soils where high Cl concentrations in soil solution are not unusual; there, Cd will behave mainly as a neutral species (CdCl₂(0)) and as an anion (CdCl₃(-) and CdCl₄(2-)), rather than as a cation (Cd(2+)). The SO₄ systems showed a moderate decrease in the amount of Cd sorbed with respect to the ClO₄ systems for the same salt concentrations. This observation was interpreted as due to the presence of a fraction of Cd in solution as the CdSO₄(0) species. (Skogerboe-Colorado State)
W77-09658

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

CHEMICAL DISTRIBUTION AND GASEOUS EVOLUTION OF ARSENIC-74 ADDED TO SOILS AS DSMA-(74)AS, Tennessee Univ., Knoxville. Dept. of Plant and Soil Science; and Tennessee Univ., Knoxville. Agricultural Experiment Station. M. B. Akins, and R. J. Lewis. Soil Science Society of America Journal, Vol. 40, No. 5, p 655-658, September-October 1976. 5 tab, 17 ref.

Descriptors: *Arsenic compounds, Organic matter, Soil moistures, Soils, Soil investigations, *Distribution, *Path of pollutants, Soil treatment. Identifiers: *Arsenic residues(Soils).

Gaseous evolution of (74)As from a soil treated with arsenic-74 labeled disodium methanearsonate at 100 micro g/g was a function of organic matter addition and moisture conditions. Loss of (74)As was greatest from soils that received an exogenous carbon source and were maintained under wet conditions. Arsenic-74 sorbed by soils of pH 4, 6, and 8 was fractionated by a differential dissolution procedure commonly used for phosphorus. Iron arsenate (soluble in 0.1N NaOH) was the most abundant form followed by aluminum arsenate (soluble in 0.5N NH4F). The soils generally contained more aluminum arsenate at pH 4 than at pH 6 or 8. Calcium arsenate fractions (soluble in 0.5N H2SO4) were usually higher at pH 6 and 8 than at pH 4. Water-soluble forms and nonextractable forms were inversely proportional to each other. (Skogerboe-Colorado State) W77-09659

COMPETITION FOR MERCURY BETWEEN RIVER SEDIMENT AND BACTERIA, Ottawa Univ. (Ontario). Dept. of Biology. S. Ramamoorthy, S. Springthorpe, and D. J. Kushner. Bulletin of Environmental Contamination and Toxicology, vol 17, no 5, p. 505-511, 1977 1 tab, 2 fig, 14 ref.

Descriptors: *Mercury, Metals, *Sediments, Water quality, Water pollution effects, *Path of pollutants, Laboratory tests, *Bacteria, *Microorganisms, *Sediment-water interface, Clay minerals, *Canada. Identifiers: *Clay sediments, Pseudomonas, *Mercury ions, *Mercury exchange, *Ottawa River.

Laboratory experiments show that bacteria compete very effectively with sediment in accumulating mercuric ions from river water. (Katz) W77-09661

MERCURY ACCUMULATION BY LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN RECENTLY IMPOUNDED RESERVOIRS, Clemson Univ., S.C. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 5C. W77-09667

HISTOPATHOLOGIC ALTERATIONS IN SHELL GLAND ACCOMPANYING DDT-INDUCED THINNING OF EGGSHELL, Army Veterinary Corps, Aberdeen Proving Grounds, Md. Veterinary Pathology Biomedical Labs. For primary bibliographic entry see Field 5C. W77-09673

NITROGEN FIXATION IN ARCTIC MARINE SEDIMENTS: EFFECT OF OIL AND HYDROCARBON FRACTIONS, Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Microbiology. R. Knowles, and C. Wishart. Environmental Pollution, vol. 13, p 133-149, 1977. 7 fig., 9 tab., 30 ref.

Descriptors: *Oil, Water pollution effects, *Sediments, *Nitrogen fixation, *Arctic, *Bacteria, *Anaerobic bacteria, *Inhibitors, Nitrogen cycle, Bottom sediments, Bottom sampling, Laboratory tests, Carbon cycle, Clostridium, Carbohydrates, Organic compounds. Identifiers: *Arctic marine sediments.

Nitrogen fixation (acetylene reduction was measured in grab and core samples of sediments from the Beaufort Sea and Eskimo Lakes, Northwest Territories, Canada. Very low rates (about mg N/square meter/year) were detected in untreated sediments. Activity was stimulated by the addition of glucose, sucrose, lactose, mannitol, and malate but much less so by acetate; negligible activity was supported by N-acetylglucosamine. There was no consistent effect of the presence or absence of oxygen. Nitrogen fixation potentials in glucose-supplemented sediment samples showed large variation between stations, between samples from the same station and between depths within single cores down to 18 cm. Weathered Norman Wells crude oil, hexane, decane, dodecane, and hexadecane had no effect on nitrogen fixation or carbon dioxide evolution. There was no evidence of the utilization of any of the hydrocarbons tested during periods of over 30 days under experimental conditions. (Katz) W77-09676

THE EFFECT OF WIND ON THE DISTRIBUTION OF CHLOROPHYLL A AND CRUSTACEAN PLANKTON IN A SHALLOW EUTROPHIC RESERVOIR, University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology. D. G. George, and R. W. Edwards. The Journal of Applied Ecology, vol. 13, no. 3, p 667-704, December 1976. 2 tab, 20 fig, 28 ref.

Descriptors: *Zooplankton, *Algae, *Cyanophyta, *Chlorophyll, *Distribution patterns, *Spatial distribution, *Winds, *Air circulation, Shallow water, Reservoirs, Crustaceans, Lake breezes, Eutrophication, Water pollution effects, *Path of pollutants. Identifiers: Eglwys, Ngnydd, *Wales(South).

The horizontal and vertical distribution patterns of chlorophyll a and crustacean zooplankton in a shallow reservoir were studied in relation to wind-induced water movements. Plankton distribution patterns could be explained in terms of an interaction between the vertical movement of the organisms and mechanical transport. When green algae or diatoms were dominant, chlorophyll remained homogeneously distributed both vertically and horizontally. Bouyant blue-green algae and positively phototactic crustacea both tended to accumulate downwind. Local concentrations of blue-green algae appeared at wind speeds below 400 cm/s. Zooplankton patches were capable of forming even under high winds. Using the ratio of mean crowding to mean density as an index of vertical and horizontal heterogeneity, the formation of horizontal aggregations in both blue-green algae and the zooplankton could be predicted from a knowledge of their vertical distribution. The appearance of systematic concentration gradients in the blue-green algae provided a basis for a crude model of algae accumulation. A series of empirical relationships was derived, and used to forecast conditions under which undesirable downwind accumulations of blue-green algae could occur. (Katz) W77-09679

SEASONAL VARIATION IN TEMPERATURE, SALINITY, AND DENSITY OVER THE CONTINENTAL SHELF OFF OREGON, Oregon State Univ., Corvallis. School of Oceanography. For primary bibliographic entry see Field 2L. W77-09703

THE EFFECT OF EXCHANGE REACTIONS BETWEEN FRASER RIVER SEDIMENT AND SEAWATER ON DISSOLVED CU AND ZN CONCENTRATIONS IN THE STRAIT OF GEORGIA, British Columbia Univ., Vancouver. Inst. of Oceanography. For primary bibliographic entry see Field 2L. W77-09707

FLUSHING CHARACTERISTICS OF A MISSISSIPPI DEAD-END CANAL SYSTEM, University of Southern Mississippi, Hattiesburg. Dept. of Geology. O. L. Paulson, Jr., G. F. Pessoney, H. Battalora, R. Williams, and J. Eastman. Water Resources Bulletin, Vol. 13, No. 2, p 341-348, April 1977. 5 fig, 13 ref.

Descriptors: *Canals, *Water circulation, *Water pollution sources, *Mississippi, Tides, Tidal waters, Dye releases, Dye concentration, On-site investigations, Water temperature, Salinity, Conductivity, Coliforms, Hydrogen ion concentration, Turbidity, Biochemical oxygen demand, Dissolved oxygen, Bathymetry, Coasts, Path of pollutants. Identifiers: *Canal flushing, Dead-end canals, Man-made canals, Residential canals.

A study of residential canal system on the Mississippi Gulf Coast and adjacent natural water bodies was conducted to determine the relationship in flushing characteristics between man-made and natural systems. The comparison was based on measurements of temperature, salinity, conductivity, coliform, pH, transparency, biological oxidation demand, dissolved oxygen, bathymetry, tides, water velocity, and Rhodamine dye concentrations. The results indicate that coliform bacteria increase with increasing distance of stations from St. Louis Bay and dissolved oxygen decreases in a similar manner. Biological oxidation demand was low at all stations; showing no differences between natural and man-made systems. The canal system studied was shallower than adjacent water bodies, and water velocities in the canal system are a function of tidal amplitude. Velocities in the river are affected by both tides and runoff. The other parameters measured show little or no difference between natural and man-made systems, but reflect overall seasonal changes. Flushing rates between the residential canal systems and an adjacent natural system are equivalent on the basis of decline in dye concentrations measured over a five-day period. (Sims-ISWS) W77-09721

DOMESTIC AND AGRICULTURAL CONTRIBUTIONS TO THE INPUTS OF PHOSPHORUS AND NITROGEN TO LOUGH NEAGH, Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit. R. V. Smith. Water Research, Vol. 11, No. 5, p 453-459, May 1977. 4 fig, 10 tab, 15 ref.

Descriptors: *Water pollution sources, *Lakes, Pollutants, *Nutrients, *Nitrogen, *Nitrates, *Phosphorus, Animal populations, Domestic animals, Agriculture, Agricultural runoff, Cities, Urban runoff, Urbanization, Rivers, Foreign countries, Foreign research, Drainage, Runoff, Water pollution, *Path of pollutants. Identifiers: *Lough Neagh(Northern Ireland), *Northern Ireland.

Loadings of nitrogen and phosphorus from the major river catchments that contribute to Lough Neagh were measured for the years 1971-1974. Analysis of the data indicated that there was a very significant correlation between soluble ortho-P loadings and the human, but not the animal, population densities of the catchments. The land drainage and agricultural contribution of soluble ortho-P to Lough Neagh was 0.14 kg P/ha/yr.

which was about 25% of the measured soluble ortho-P loading to the Lough. It was estimated that the introduction of phosphorus removal treatment at sewage works connected to populations greater than 2000 could curtail 50% of the phosphorus available to support algal growth in the Lough. There was a good correlation between nitrogen fertilizers usage in Northern Ireland and the nitrate concentration in the major rivers. (Sims-ISWS)
W77-09722

LOGGING ROADS AND PROTECTION OF WATER QUALITY.

Arnold, Arnold and Associates, Seattle, Wash.; and Dames and Moore, Seattle, Wash.
For primary bibliographic entry see Field 5G.
W77-09725

LOADING FUNCTIONS FOR ASSESSMENT OF WATER POLLUTION FROM NONPOINT SOURCES.

Midwest Research Inst., Kansas City, Mo.
A. D. McElroy, S. Y. Chiu, J. W. Nebgen, A. Aletti, and F. W. Bennett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 325. Price codes: A20 in paper copy, A01 in microfiche. Environmental Protection Agency Technology Series, Report EPA-600/2-76-151, May, 1976. 465 p, 50 fig, 89 ref, 75 tab.

Descriptors: *Water pollution sources, Water pollution, Runoff, Salinity, Nitrogen, Phosphorus, Pesticides, Urban runoff, Mine wastes, Farm wastes, Agricultural runoff, Construction, Surface runoff, Nutrients, Model studies, Hydrology, Heavy metals, Pollutants, Forests, Watersheds(Basins), *Waste assimilative capacity.
Identifiers: *Nonpoint pollution sources, *Waste loading functions.

Methods for evaluating the quantity of water pollutants generated from nonpoint sources, including agriculture, silviculture, construction, mining, runoff from urban areas and rural roads, and land disposal sites, are developed and compiled for use in water quality planning. The loading functions, plus in some instances emission values, permit calculation of nonpoint source pollutants from available data and information. Natural background was considered to be a source and loading functions are presented to estimate natural or background loads of pollutants. Loading functions/values are presented for average conditions, i.e., annual average loads expressed as metric tons/hectare/year (tons/acre/year). Procedures for estimating seasonal or 30-day maximum and minimum loads are also presented. In addition, a wide variety of required data inputs to loading functions, and delineation of sources of additional information are included in the report. An evaluation of limitations and constraints of various methodologies which will enable the user to employ the functions realistically is also presented. (Witt-IPC)
W77-09726

USING OXYGEN DEMAND INDEX, COD, AND BOD TESTS TO CHARACTERIZE KRAFT MILL EFFLUENT,
Saint Mary's Univ., Halifax (Nova Scotia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-09729

CHARACTERIZATION OF SPENT BLEACHING LIQUORS. PART 1, SPENT LIQUORS FROM THE CHLORINE AND ALKALI EXTRACTION STAGES IN THE PREBLEACHING OF PINE KRAFT PULP,
Swedish Forest Products Research Lab., Stockholm.
For primary bibliographic entry see Field 5A.

W77-09731

DILUTION CHARACTERISTICS OF EFFLUENTS IN DEEP WATER RESERVOIRS DETERMINED WITH A RADIOACTIVE INDICATOR (ON THE EXAMPLE OF LAKE BAIKAL), (IN RUSSIAN), V. A. Vetrov, and S. A. Dekii.

In: Materialy Vsesoyuznogo Nauchnogo Simpoziuma Sovremennym Problemam Samoochishcheniya Regulirovaniya Kachestva Vody, 5th, Vol. 1, p 22-27, 1975. 4 fig, 3 ref.

Descriptors: *Deep water, *Waste dilution, *Tracers, *Pulp wastes, Wastes, Industrial wastes, Water pollution sources, Gold radioisotopes, Pollutants, Foreign countries, Chlorides, Ions, Radioactivity, Water quality, Pulp and paper industry.
Identifiers: *Lake Baikal(USSR), *USSR.

The dilution of pollutants in deep natural waters can be determined using a radioactive isotope as indicator. The indicator is added at the point of effluent discharge, and the radioactivity in various zones of the water reservoir is measured by means of a probe lowered from a vessel. From data thus collected, the dilution coefficients can be calculated, and from such coefficients in a large area a dilution field can be obtained and used to predict concentrations of pollutants. This method was used to determine the distribution of effluent from the Baikal pulp and paper mill in Lake Baikal. The indicator was Au-198 (in the form of chlorauric acid) which has a half-life of 2.7 days. The experiments were conducted over a period of 3 years, during various seasons. From the data obtained, a model of dilution was drawn to a depth of 50 m. This model was compared with the concentrations of chloride ions at the same measurement points, and the coefficients of chloride ion dilution were calculated. There was a good correlation between the two sets of measurements. (Stapinski-IPC)
W77-09735

NITRATE AND PHOSPHATE CONTENT OF GROUND AND SURFACE WATERS OF THE WHITE RIVER DRAINAGE, NORTHWEST NEBRASKA, Union Coll., Middlesboro, Ky. Environmental Education Center. C. E. Baker.

Trans Nebr Acad Sci. Vol 2, p 144-151, 1973.

Descriptors: *Phosphates, *Nitrates, Water pollution sources, Water pollution effects, Drainage, Nebraska.
Identifiers: Cyanosis, Infants, White River(Neb), Methemoglobinemia.

Selected stream and ground water sites in the White River Drainage Basin were sampled for phosphate and nitrate content. The sampling procedure was designed to elucidate the impact of each tributary drainage area on water quality of the White River. Concentration of nitrates found in surface waters was 5.7 plus or minus 1.75 ppm (X plus or minus SD), while that of phosphates was 0.67 plus or minus 0.33 ppm. Ground water contained higher concentrations of both contaminants, 8.81 plus or minus 0.66 ppm for nitrates and 0.82 plus or minus 0.20 ppm for phosphates. The White River increased in nitrate content at each downstream sampling site. Values ranged from 4.4 ppm near the headwaters to 7.7 ppm at the farthest point sampled downstream. The highest nitrate concentration found in any stream sampled was 9.9 ppm, and the highest in ground water was 25.7 ppm. These concentrations, especially the latter, are high enough to induce cyanosis due to methemoglobinemia if consumed by infants.--
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W77-09743

WATER TRANSPORT OF WOOD (IN CANADA); THE CURRENT SITUATION,
Environmental Protection Service, Regina (Saskatchewan). Water Pollution Control Branch.
For primary bibliographic entry see Field 5C.
W77-09755

FOREST HARVEST, RESIDUE TREATMENT, REFORESTATION, AND PROTECTION OF WATER QUALITY.
Montgomery (James M.), Inc., Boise, Idaho.
For primary bibliographic entry see Field 5G.
W77-09756

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS - VOLUME I - RADFORD,
WAPORA, Inc., Washington, D.C.
For primary bibliographic entry see Field 5C.
W77-09761

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS, VOL. II - HOLSTON - FINAL REPORT,
WAPORA, Inc., Washington, D.C.
For primary bibliographic entry see Field 5C.
W77-09762

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS, VOLUME IV - MILAN, FINAL REPORT,
WAPORA, Inc., Washington, D.C.
For primary bibliographic entry see Field 5C.
W77-09763

CATALYTIC DEOXYGENATION OF AQUEOUS SOLUTIONS BY HYDRAZINE,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
P. A. Lurker.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 794. Price codes: A02 in paper copy, A01 in microfiche. Report AMRL-TR-76-23, May 1976. 19 p, 6 tab, 8 ref.

Descriptors: Oxygen, *Dissolved oxygen, Aqueous solutions, *Catalysts, *Iron, *Zinc, *Cobalt, *Nickel, Metals, Ions.
Identifiers: *Catalytic kinetics, *Reaction rates, *Hydrazine, 1,1-dimethyl-hydrazine, Unsymmetrical dimethyl hydrazine, *Catalytic deoxygenation, Reactions, *Propellants.

The catalytic effects of metallic ions at their reported maximum environmental water concentrations were studied in the deoxygenation by hydrazine in aqueous solutions. Fe(III), Fe(II), Zn(II), Co(II), and Ni(II) ions did not significantly enhance the deoxygenation of aqueous solutions. The thermal effects of the kinetic deoxygenation rate for hydrazine, MMH, and UDMH by the catalytic reactions with copper were studied. Previous work at this lab established a predictive model for the deoxygenation kinetic rate constant as a function of propellant and copper concentration. This was expanded to include a thermal ratio parameter. (Katz)
W77-09766

GEOCHEMICAL INTERACTIONS OF HEAVY METALS IN SOUTHEASTERN SALT MARSH ENVIRONMENTS,
Skidway Inst. of Oceanography, Savannah, Ga.
H. L. Windom.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 250. Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA 600/3-76-023, March 1976. 35 p, 7 tab, 8 fig, 20 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: *Metals, *Mercury, *Cadmium, *Salt marshes, *Path of pollutants, Estuaries, *Geochemistry, Flocculation, Sediments, Water pollution, *Heavy metals, *Iron, *Manganese, *Salinity, Carbon, Southeast U.S.
Identifiers: *Metal complexes, Salt water sediments, *Heavy metal geochemistry, *Heavy metal transport, *Estuarine geochemistry, Coastal littoral waters, Salt marsh estuaries.

Results are summarized of a three year study of the transport, fate and geochemical interactions of mercury, cadmium, and other inorganic pollutants in the southeastern coastal littoral-salt marsh environment. The general objectives of the study were to determine: (1) the rate of input of these materials to salt marsh estuaries, (2) the geochemical interaction they experience there and, (3) their ultimate fate in coastal littoral waters. The results provide a base for future evaluation of the rates of inputs of the metals studied and their existing concentrations in the water and sediment column of salt marsh estuaries. The interactions of metals with organic matter in rivers and estuaries and their effect on transport and fate are discussed. The effects of processes such as flocculation, precipitation, adsorption, and desorption from particles in estuaries are evaluated. The distribution and rate of accumulation of Hg, Cd and other metals in salt marsh sediments are compared to their inputs to determine the amount of these metals that ultimately reach coastal littoral waters. And finally, the residence time of Hg and Cd in coastal littoral waters is estimated from their input rates and concentrations. (Katz)
W77-09767

VARIATIONS IN THE ABUNDANCE OF CHANNEL CATFISH YEAR CLASSES IN THE UPPER MISSISSIPPI RIVER AND CAUSATIVE FACTORS, Iowa State Conservation Commission, Des Moines. Fisheries Section.
For primary bibliographic entry see Field 5C.
W77-09768

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: KETONIC SOLVENTS, Syracuse Research Corp., N.Y. Center for Chemical Hazard Assessment.
S. A. Lande, P. R. Durkin, D. H. Christopher, P. H. Howard, and J. Saxena.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 970, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency, Office of Toxic Substances, Report EPA-560/2-76-003, May, 1976. 330 p., 104 tab., 42 fig., 471 ref.

Descriptors: *Public health, *Solvents, Environment, Environmental effects, Chemical properties, Physical properties, Path of pollutants, *Freshwater fish, Aquatic environment, Pollution abatement, *Reviews, Water pollution, Bibliographies.
Identifiers: *Environmental hazards, *Ketonic solvents, *Cyclohexane, *Methyl ethyl ketone, *Methyl isobutyl ketone, *Isophorone, *Mesityl oxide, Environmental contamination, Bioconcentration, Bioaccumulation.

A review is presented of the potential environmental hazard from the commercial use of ketonic solvents, with the exception of acetone. Three ketones - cyclohexanone, methyl ethyl ketone, and methyl isobutyl ketone - dominate the market. Other commercial ketonic solvents include diacetone alcohol, isophorone, methyl oxide, and acetophenone. Information on physical and chemical properties, production methods and quantities, commercial uses and factors affecting environmental contamination, as well as information related to health and biological effects, are reviewed. (Katz)
W77-09770

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL OF DEEP-SEA SEDIMENT BACTERIA, Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-09772

WATER QUALITY: WESTERN FISH TOXICOLOGY STATION AND WESTERN OREGON RIVERS, Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5A.
W77-09777

NATIONWIDE EVALUATION OF COMBINED SEWER OVERFLOWS AND URBAN STORM-WATER DISCHARGES. VOLUME II: COST ASSESSMENT AND IMPACTS, Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5D.
W77-09874

STUDY OF THE DECOMPOSITION OF ORGANIC MATTER BY THE RESPIROMETRIC DILUTION METHOD (UNTERSUCHUNGEN UEBER DAS ABBAUVERHALTEN ORGANISCHER STOFFE MIT HILFE DER RESPIROMETRISCHEN VERDUENNUNGSMETHODE),
For primary bibliographic entry see Field 5D.
W77-09888

ADVANCE SEWER PLANNING FOR RIO DE JANEIRO COASTLINE, ENCIBRA South America, Rio de Janeiro (Brazil).
For primary bibliographic entry see Field 5D.
W77-09890

CHANGES IN INORGANIC NITROGENOUS COMPOUNDS FROM SEPTIC TANK EFFLUENT IN A SOIL WITH A FLUCTUATING WATER TABLE, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. B. Reneau Jr.
Journal of Environmental Quality, Vol. 6, No. 2, p 173-178, April-June, 1977. 6 fig, 4 tab, 26 ref.

Descriptors: *Nitrogen compounds, *Septic tanks, *Water table, *Nitrification, *Denitrification, Oxidation-reduction potential, *Soil disposal fields, Water table aquifer, Perched water, Chemical properties, Chemical reactions, Adsorption, Aerobic conditions, Anaerobic conditions, Soils, Monitoring, *Waste water disposal.

The fate of septic tank effluent inorganic nitrogenous fractions in soil was investigated. A Virginia test site had been used for nearly 15 years. The soil was a Varina sandy loam that was very slowly permeable to water and air. This resulted in a fluctuating water table. The septic tank system discharged about 700 gpd of effluent. The compounds monitored were NO₃(-), NO₂(-), and NH₄(+), above and in the plinthic material. Redox potentials, pH, dissolved oxygen, and temperature were determined for field sub-samples. Inorganic N was found in septic tank effluent largely in the form of NH₄(+). These concentrations significantly decreased with distance from the drainfield. A reduction from 23 to 4.1 micrograms/milliliter was found 12 meters from the drainfield. Nitrate and nitrite concentrations, above the plinthic materials, remained at substantially the same levels for all distances. Decreased NH₄(+) concentrations, as a function of distance from the drainfield, were due to the anaerobic decomposition of organic matter and to denitrification. At the 1.27-meter distance, NO₂(-) accu-

mulations probably indicated nitrification inhibition by high NH₄(+) concentrations or heterotrophic conversion of NH₄(+) to NO₂(-). Nitrification and denitrification above the plinthic layer at this distance were possibly enhanced by the fluctuating water table. Data indicated that anaerobic conditions were sufficient to cause denitrification to a distance of 6.1 meters. Redox potentials near +200 mV (adjusted to 25C and pH7) were suggested in denitrification areas. Nitrite and NO₃(-) in the plinthic horizon were not subjected to denitrification. Conditions for biological denitrification were not favored in this horizon. (Collins-FIRL)
W77-09907

A MATHEMATICAL MODEL FOR WATER QUALITY IN A COASTAL REGION IN TERMS OF SEA BOTTOM WASTE DEPOSITS (KAITEI OSENBUSSHITSU NADO NO EIKYO O KORYO SHITA KAIKI NO SUISHITSU NO YOSOKU-MODERU NO KAIHATSU NI KANSURU KEN-KYU), Public Works Research Inst., Tokyo (Japan). H. Hashimoto, and T. Uda.
Kankochi Kogai Semmon Shiryo, Vol. 12, No. 1, p 66-81, 1977. 7 ref.

Descriptors: *Water quality, *Model studies, *Estuaries, Water quality control, *Mathematical models, Analysis, Chemical oxygen demand, Sedimentation, Adsorption, Organic matter, Waste disposal, Tidal effects, Dissolved oxygen, Suspended solids, Coasts.

A mathematical model was developed to evaluate the effect of waste water treatment levels, the establishment of sewage systems, and the control of land use for estuarine water quality control. Physical, chemical, and biological processes were investigated. Field data were analyzed in the Seto Inland Sea. Three-fourths of the total influent COD was removed by sedimentation, absorption, or decay. The remainder was dispersed to the Pacific Ocean. Seasonal variations of COD in summer and in winter were clear. Organic matter reproduction was active in summer and had an effect on water quality. Thermocline developed in water at depths of 5-10 meters. Convection and dispersion by tidal currents and the decay and reproduction of organic matter should be included in the model. Analyses of density effects were carried out by two layer tidal computation. Inclusion of tidal flow dispersion in the diffusion equation is advantageous, although it is difficult to calculate the diffusion coefficient. Consumption of dissolved oxygen, organic matter suspension due to tidal flow, and dissolution of bed nutrients determine the effect of waste deposits on water quality. The importance of waste deposits is not clearly understood due to the lack of data. A mechanical turbulence generator was developed to analyze mechanisms involved in waste deposit suspension. (Collins-FIRL)
W77-09911

THE IDENTIFICATION AND ADAPTIVE PREDICTION OF URBAN SEWER FLOWS, Cambridge Univ. (England). Dept. of Engineering. M. B. Beck.
International Journal of Control, Vol. 25, No. 3, p 425-440, March, 1977. 7 fig, 21 ref.

Descriptors: *Model studies, *Flow, *Sewers, *Treatment facilities, Hydrologic data, Overflows, Urban areas, Rainfall, Theoretical analysis, *Waste water treatment.

Studies were conducted to develop models for the identification and prediction of urban sewer input flows to treatment plants. Plant operations would be enhanced by a more precise knowledge of input material, which varies with time. Such knowledge would also minimize storm water overflows from sewers. Results were presented for identification of a stochastic input-output, time-series model

using the maximum likelihood method. Two steps were involved in the prediction problem: black-box model predictions estimated recursively with a least squares technique, and plant inflow prediction by a newly updated model and parameter estimates. The identification problem involved the determination of a dynamic model which related given rainfall measurements to the flow component. Adaptive prediction should identify the process equation by maximum likelihood methods; compute optimal, minimum variance, predictor; and compare the adaptive predictor for the unknown process with the optimal predictor for the known process. The major limitation of adaptive prediction was the poor quality of the data. (Collins-FIRL)
W77-09914

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,

Weston (Roy F.), Inc., West Chester, Pa.
A. A. Metry.
Journal of Environmental Sciences, Vol. 20, No. 2, p 27-31, March/April, 1977. 8 fig.

Descriptors: *Water pollution sources, *Pollutant identification, *Groundwater, *Model studies, Aquifers, Waste disposal, Seepage, Deep wells, Solid wastes, Leachates, Analysis, Water quality.

Groundwater will continue to be a growing source of water supply and aquifers may become alternatives for direct and indirect disposal of liquid and solid wastes. Groundwater pollution can develop from several sources: waste water disposal on land, seepage from waste water holding basins, deep well injection, and leachates from solid waste disposal. Two models were developed to predict leachate/pollutant migration and fate in subsurface environments. The first was a one-dimensional model for pollutant attenuation prediction in saturated media (soils), and the second was a two-dimensional model for pollutant migration and fate prediction in saturated media (aquifers). The models include the mass-transport mechanisms of molecular diffusion, convective dispersion, and chemical reaction. These models are flexible and practical, accurate, and have a sound mathematical basis. (Collins-FIRL)
W77-09915

CARBON ISOTOPIC STUDY OF THE FATE OF LANDFILL LEACHATE IN GROUNDWATER,

Indiana Univ., Bloomington. Dept. of Chemistry.
L. M. Games, and J. M. Hayes.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 668-677, April, 1977. 7 fig, 6 tab, 22 ref.

Descriptors: *Isotope studies, *Carbon, *Leachate, *Groundwater, *Landfills, Analytical techniques, Water pollution, Water pollution effects, Waste disposal, Chemical properties, Waste water treatment.

An isotopic study was conducted to gain information on carbon movement in groundwater and on the effects of a landfill on the presence of different carbon molecular forms. Oversimplification was avoided by the simultaneous study of four carbon fractions - inorganic carbon, volatile organic carbon, non-volatile organic carbon, and CO and CH₄. It was concluded that soil microorganisms quickly modified the bulk of mobile carbon entering the groundwater system from the landfill. Non-volatile organic carbon was effectively immobilized. Though the landfill did not significantly alter the bulk carbon budget, it is possible that trace amounts of unusually mobile materials could have entered the aquifer. These might be highly toxic with a negative effect on water quality, even in small quantities. Large variations of amounts and isotope ratios with time suggested the need for a longer study period. The isotopic method made available direct bulk carbon information for organic chemical aspects. It was also a good data

source for the effects of soil microorganisms on groundwater carbon. (Collins-FIRL)
W77-09917

GROUNDWATER POLLUTION HAZARD NEAR SANITARY LANDFILLS ON THE GLACIATED PLAINS, NORTH DAKOTA - A STUDY OF THE LANGDON, NORTH DAKOTA SANITARY LANDFILL,

Geological Survey, Grand Forks, N. Dak.
B. M. Arndt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 466, Price codes: A05 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Completion Report No. WI-221-039-76, May 1977. 38 p, 3 tab, 35 fig, 3 plates, 23 ref, 4 append. North Dakota Geological Survey Open File Report OF-1. OWRT A-038-NDAK(1), 14-31-0001-5034.

Descriptors: *Hydrogeology, Groundwater, *Landfills, *Water analysis, Sampling, Glacial sediments, *North Dakota, *Path of pollutants, Pollutant identification, Water pollution sources, *Dissolved solids.
Identifiers: Langdon(N Dak).

The objectives of the study of the Langdon landfill were threefold: (1) to define the geologic and hydrologic setting of the landfill site; (2) to gather information pertaining to quantity, types, and migration of dissolved solids from the landfill into the groundwater flow system; and (3) to evaluate the criteria used in the study of this landfill and their applicability to landfill sites in similar geologic settings in North Dakota. Eleven water-sampling wells placed in the landfill site were periodically sampled over an 18-month period for water-quality analyses. These analyses included Ca, Na, K, NH₃, HCO₃, PO₄, SO₄, Cl, COD, BOD, pH, electrical conductivity, and total hardness. The analyses indicate no significant alteration of groundwater quality as a result of the presence of refuse. Some contamination of groundwater by ammonia, phosphate, and nitrate occurs in those wells near the perimeter of the landfill. The landfill site is surrounded on three sides by cropland, and those wells closest to this land indicate alteration as a result of crop fertilization. However, in no case are Public Health Standards for drinking water exceeded. The findings suggest that groundwater contamination by proper solid waste disposal methods is not a serious threat in most of North Dakota, a conclusion that seems valid for at least the glaciated parts of the state. The Langdon landfill is atypical of many landfill sites in the state because it is located in a gravel pit. Many landfills are located in glacial sediment that has substantially lower hydraulic conductivities, thereby decreasing even more the rate at which groundwater can move through a site.
W77-09925

BUOYANT SURFACE JETS DISCHARGED INTO A STRONG CROSSFLOW,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
C.-Y. Lin, E. R. Holley, W. Hall, and C. Maxwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 455, Price codes: A11 in paper copy, A01 in microfiche. Illinois Water Resource Center, Urbana, Research Report No. 124, April 1977. 216 p, 61 fig, 3 tab, 88 ref, append. OWRT B-088-III(1).

Descriptors: Fluid mechanics, *Heated water, *Mixing, Interfaces, Rivers, *Thermal pollution, *Thermal stratification, *Water temperature, *Jets, Model studies, Dispersion, Waste dilution, *Distribution patterns, Path of pollutants, Buoyancy.
Identifiers: Crossflow, *Temperature distribution.

Analytical and experimental investigations were carried out for three-dimensional buoyant surface

jets with strong ambient flow but without boundary attachment. A numerical model in curvilinear coordinates was developed from an integral jet analysis modified for buoyancy effects and included a symmetry of the jet. Detailed temperature distributions were measured in the laboratory with dissimetric Froude numbers (Fo) of 5, 10 and 15 and velocity ratios (R) from 2 to 13. Experimental results showed that ambient crossflows can cause significant distortion of the jet, even for R = 13. Near the exit, the lower portion of the jet is swept toward the lee side of the jet. The resulting L-shaped cross section and the associated density instability may enhance spreading on the lee side and may contribute to the subsequent formation of bimodal temperature distributions. The jet bending increases as R decreases and as Fo increases. Dilution increases with increasing Fo and decreasing R. The model was calibrated against the entire set of measured temperatures for each run and is capable of predicting temperature distributions to an accuracy of 0.63C. The agreement could probably be improved by using similarity profiles better suited to the actual jet cross sectional shape which was not known at the beginning of the research.
W77-09926

GEOCHEMICAL CONTROLS ON TRACE ELEMENT CONCENTRATIONS IN NATURAL WATERS OF A PROPOSED COAL ASH LANDFILL SITE,

Kansas State Univ., Manhattan. Dept. of Geology.
D. O. Whittemore, and J. Switek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 429, Price codes: A05 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Manhattan, KWRRI Contribution No. 188, April 1977. 76 p, 7 fig, 40 tab, 33 ref, append. OWRT A-070-KAN(1), 14-31-0001-6017.

Descriptors: *Trace elements, Water quality, Soil chemistry, *Kansas, *Sediments, Iron, Manganese, Copper, Lead, Zinc, Cadmium, Chromium, Selenium, Arsenic, *Landfill, *Path of pollutants, Distribution, Industrial wastes, *Metals, Groundwater, Watersheds(Basins), Drainage basin.
Identifiers: Coal ash landfill, Sediment pore water chemistry.

The distributions of Fe, Mn, Cr, Cu, Pb, Zn, Cd, As, and Se were studied in rocks, soils, stream sediments, and natural waters of a small upland drainage basin near a coal-fueled power plant being built in northeastern Kansas. Analyses of the total and dilute acid soluble fractions of rocks, soils, and stream sediments indicated that most trace metals are either concentrated in hydrous Mn and Fe oxides or left in clays after the weathering of the limestone and calcareous shale bedrock. Average exchangeable and chelateable concentrations of minor and trace metals ranged from < 0.01% (for Cr) to 26% (for Mn) of the total amounts in soils and sediments. The dissolved trace metal concentrations in natural waters were well below recommended standards for drinking waters. The slightly acidic nature of rain and snow allowed higher dissolved metal concentrations than in the ground and surface waters. The pH's of the spring and stream waters were 7.1 + or - 0.1 and 8.2 + or - 0.2, respectively, and were well buffered by dissolved carbonate species. Thus, precipitation as oxides, hydroxides, and carbonates, and adsorption on solid surfaces kept dissolved trace metals concentrations very low. Values ranged from < 0.01 to 6 micrograms/l for all metals except Fe, Mn, and Zn, which were occasionally > 6 micrograms/l. When the power plant is operative, most trace metals released to the environment should either accumulate in soils and sediments after precipitation as oxides, hydroxides, and carbonates or adsorption on clays and hydrous Mn and Fe oxides, or be carried out of the watershed in suspended matter in streams.
W77-09928

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

TRANSMISSION SPECTROSCOPY EXAMINATIONS OF NATURAL WATERS-C. ULTRAVIOLET SPECTRAL CHARACTERISTICS OF THE TRANSITION FROM TERRESTRIAL HUMUS TO MARINE YELLOW SUBSTANCE, Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
For primary bibliographic entry see Field 5A.
W77-09945

INTERACTIONS BETWEEN ZINC AND SUSPENDED SEDIMENTS IN THE FRASER RIVER ESTUARY, BRITISH COLUMBIA, British Columbia Univ., Vancouver. Dept. of Geological Sciences.
D. Grieve, and K. Fletcher.
Estuarine and Coastal Marine Science, Vol 5, No 3, p 415-419, May 1977. 2 fig, 1 tab, 16 ref.

Descriptors: *Zinc, *Heavy metals, *Rivers, *Canada, Sediments, Suspended solids, Estuaries, Chemicals, Iron, Manganese, On-site investigations, Sampling, Water temperature, Conductivity, Adsorption, Pollutants, *Path of pollutants, Water pollution, Pollutant identification.
Identifiers: *Fraser River, *British Columbia.

Behavior of Zn was studied in the Fraser River estuary. Increases in dissolved and suspended Zn in the mixing zone between fresh and brackish waters demonstrate the importance of both adsorption and desorption phenomena in estuarine waters. Together with estuarine circulation, adsorption and desorption provide a mechanism for retention of heavy metals in coastal zone sediments and waters. (Sims-ISWS)
W77-09949

AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM COMPOUNDS ON CALCAREOUS SOILS: V. SOIL WATER CONTENT AND METHOD OF NITROGEN APPLICATION, Texas A and M Univ., El Paso. Agricultural Research Station.
For primary bibliographic entry see Field 2G.
W77-09960

THE INFLUENCE OF CATION EXCHANGE CAPACITY AND DEPTH OF INCORPORATION ON AMMONIA VOLATILIZATION FROM AMMONIUM COMPOUNDS APPLIED TO CALCAREOUS SOILS, Texas A and M Univ., El Paso. Agricultural Research Station.
For primary bibliographic entry see Field 2G.
W77-09961

MICROBIAL INORGANIC POLYPHOSPHATES: FACTORS INFLUENCING THEIR ACCUMULATION, Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 2G.
W77-09965

AMMONIUM DIFFUSION AS A FACTOR IN NITROGEN LOSS FROM FLOODED SOILS, Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
K. R. Reddy, W. H. Patrick, Jr., and R. E. Phillips.
Soil Science Society of America Journal, Vol 40, No 4, p 528-533, July-August 1976. 6 fig, 2 tab, 36 ref.

Descriptors: *Nitrogen, *Leaching, *Nitrification, *Denitrification, Soil investigations, Ammonium compounds, Anaerobic conditions, Aerobic conditions, *Path of pollutants, Water pollution sources.
Identifiers: Ammonium diffusion, Flooded soils.

The role of $\text{NH}_4(+)\text{-N}$ diffusion in a flooded soil on nitrogen (N) loss through the nitrification-denitrification process was investigated under laboratory conditions. The distribution of applied $\text{NH}_4(+)\text{-N}$ in both the aerobic and anaerobic soil layers of a flooded soil was experimentally determined and compared with the values obtained from theoretical equations. The total loss of $\text{NH}_4(+)\text{-N}$ from the flooded soil system (15 cm depth) by nitrification-denitrification was equivalent to 12.43 g N/sq m for a 120-day incubation period when the initial concentration of $\text{NH}_4(+)\text{-N}$ was 44.84 g N/sq m. Diffusion of $\text{NH}_4(+)\text{-N}$ from the anaerobic soil layer to the aerobic soil layer accounted for more than 50% (7.16 g N/sq m) of the total $\text{NH}_4(+)\text{-N}$ loss with the remainder being lost from $\text{NH}_4(+)\text{-N}$ originally present in the aerobic layer. The $\text{NH}_4(+)\text{-N}$ that diffused upward into the aerobic soil layer was nitrified to $\text{NO}_3(-)\text{-N}$, which readily diffused back down into the anaerobic soil layer and was subsequently denitrified. (Skogerboe-Colorado State)
W77-09966

COMPUTER SIMULATION OF PHOSPHORUS MOVEMENT THROUGH SOILS, New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
R. D. Harter, and B. B. Foster.
Soil Science Society of America Journal, Vol 40, No 2, p 239-242, March-April 1976. 4 fig, 1 tab, 9 ref.

Descriptors: *Computer models, Model studies, *Phosphorus, Soil investigations, *Mathematical models, Waste water, Nutrients, Fertilization, *Path of pollutants, *Simulation analysis, Water pollution sources.

Although the movement of P through soil can be described by mathematical models, this approach has certain limitations in practical application, particularly when soil is used for waste water renovation. To circumvent the limitations of mathematical modeling, empirical adsorption equations can be obtained and utilized in computer simulation of phosphorus movement. In this way, the renovation lifetime of a soil can be estimated. This approach is not limited to P, and can be used for any potential ground-water contaminate, whether inorganic or organic. (Skogerboe-Colorado State)
W77-09970

RELATION BETWEEN THE KINETICS OF NITROGEN TRANSFORMATION AND BIOMASS DISTRIBUTION IN A SOIL COLUMN DURING CONTINUOUS LEACHING, Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 2G.
W77-09973

SAMPLING THE UNSATURATED ZONE OF IRRIGATED LANDS FOR RELIABLE ESTIMATES OF NITRATE CONCENTRATIONS, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-09974

CHANGES IN THE PHYSICAL PROPERTIES OF SOIL CLAYS DUE TO PRECIPITATED ALUMINUM AND IRON HYDROXIDES: II. COLLOIDAL INTERACTIONS IN THE ABSENCE OF DRYING, Hawaii Univ., Honolulu. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09975

MOVEMENT OF CARBARYL THROUGH CONGAREE SOIL INTO GROUND WATER, Clemson Univ., S.C. Dept. of Agronomy and Soils.

K. S. LaFleur.
Journal of Environmental Quality, Vol. 5, No. 1, p 91-92, January-March 1976. 1 fig, 3 tab, 6 ref.

Descriptors: *Soil profiles, *Groundwater, Pollutants, Soil investigations, *Path of pollutants, *Water pollution sources.
Identifiers: *Carbaryl.

Carbaryl was applied to a Congaree sandy loam fieldplot containing a shallow (about -1.1 m) water table. Movement and loss in the soil profile, and accumulation in underlying ground water were monitored for 16 months. Rainfall during this time was 182 cm (3.5 pore volumes based on the upper 1 m of soil). The upper 1 m contained about 6% of the applied carbaryl after 16 months. No carbaryl was found in the 0-20 cm layer after the 4th month. Loss of carbaryl with time in the upper 1 m was concentration-dependent. Time to half-concentration within the upper 1 m was < 1 month. Carbaryl appeared in the underlying ground water within 2 months after soil application and persisted through the 8th month. Maximum ground water concentration, about 0.3 micromol/liter, occurred at the end of the second month. (Skogerboe-Colorado State)
W77-09976

UPTAKE OF CADMIUM BY SOYBEANS AS INFLUENCED BY SOIL CATION EXCHANGE CAPACITY, PH AND AVAILABLE PHOSPHORUS, Argonne National Lab., Ill.
For primary bibliographic entry see Field 2G.
W77-09977

LONG-TERM EVALUATION OF SLOW-RELEASE NITROGEN SOURCES OF TURF-GRASS, Community Coll. of the Finger Lakes, Canandaigua, New York.
For primary bibliographic entry see Field 3C.
W77-09978

SENSITIVITY ANALYSIS OF THE WATER QUALITY FOR RIVER-RESERVOIR SYSTEMS MODEL, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
K. W. Thornton, and A. S. Lessem.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 382. Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper Y-76-4, September 1976. 49 p, 30 fig, 3 tab, 4 ref.

Descriptors: *Mathematical models, *Water quality, *Data collections, *Ecosystems, Model studies, Computer programs.
Identifiers: *Sensitivity analysis.

Most total ecosystem models require extensive data sets for initializing and calibrating the model to the prototype system. Data collection programs, however, are expensive and time-consuming. To obviate these constraints, the data collection program should be guided by a knowledge of the model sensitivity to various initial conditions and coefficients. A software program was developed for the Honeywell 600 computer system that permitted an evaluation of sensitivity of coefficients. The program permitted the display of 21 water quality variables on the same plot and a comparison of the responses produced by changing one coefficient by 10 percent. In general, the model results were more sensitive to 10-percent changes in coefficients at high nutrient concentrations than at low nutrient concentrations. The model results were quite sensitive to a 10-percent change in the evaporation and dispersion (effective diffusion) rate coefficients, biota growth, respiration, and temperature rate coefficients. Sensitivity analyses perform a useful function in modeling programs by providing insight into the interrelation of various compartments and

the overall function of the system, making possible the design of a more effective and inclusive data-collecting program. (WES)
W77-09981

WATER-RESOURCES APPRAISAL OF THE CARSON RIVER BASIN, WESTERN NEVADA,
Geological Survey, Carson City, Nev. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-09992

MODELING CHLORIDE MOVEMENT IN THE ALLUVIAL AQUIFER AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,
Geological Survey, Lakewood, Colo. Water Resources Div.
L. F. Konikow.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price 75 cents. Water Supply Paper 2044, 1977. 43 p, 19 fig, 3 tab, 28 ref.

Descriptors: *Path of pollutants, *Groundwater movement, *Industrial wastes, Chlorides, *Model studies, Estimating, Analytical techniques, Waste disposal, Ponds, Seepage, Hydrogeology, Aquifer characteristics, Evaluation, *Colorado.
Identifiers: *Rocky Mountain Arsenal(Colc).

A solute-transport model that can be used to predict the movement of dissolved chemicals in flowing ground water was applied to a problem of ground-water contamination at the Rocky Mountain Arsenal, near Denver, Colo. The model couples a finite-difference solution to the ground-water flow equation with the method-of-characteristics solution to the solute-transport equation. From 1943 to 1956 liquid industrial wastes containing high chloride concentrations were disposed into unlined ponds at the Arsenal. Wastes seeped out of the unlined disposal ponds and spread for many square miles in the underlying shallow alluvial aquifer. Since 1956 disposal has been into an asphalt-lined simulation model quantitatively integrated the effects of the major factors that controlled changes in chloride concentrations and accurately reproduced the 30-year history of chloride ground-water contamination. (Woodard-USGS)
W77-09994

ELEMENTS NEEDED IN DESIGN OF A GROUND-WATER-QUALITY MONITORING NETWORK IN THE HAWAIIAN ISLANDS,
Geological Survey, Honolulu, Hawaii. Water Resources Div.
K. J. Takasaki.
Available from Supt. of Documents, GPO, Washington, DC 20402, price \$6.35. Water-Supply Paper 2041, 1977. 23 p, 10 fig, 5 plates, 11 ref.

Descriptors: *Groundwater resources, *Hawaii, *Path of pollutants, *Network design, *Water pollution sources, Data collections, Monitoring, Water quality, Groundwater movement, Hydrologic data, Hydrogeology, Water wells, Water supply, Water users, Pollutant identification.

The elements needed in the design of a ground-water-quality monitoring network in the Hawaiian Islands are described and summarized. The elements are given by geohydrologic units which represent areas where there are similarities in the occurrence of ground water or in the geology pertinent to the occurrence of ground water. The goal is to establish a network of observation points to inventory and maintain surveillance of existing and potential sources of pollution of ground water. Of principal concern to Hawaii's environment is pollution of the potable ground-water supplies and of the near-shore recreational waters, the latter by the discharge of polluted ground water. Existing monitoring efforts, although intensive in many areas, are not adequate because they are geared

more toward (1) the detection and surveillance of pollutants in the conveyances of ground water instead of in the sources of ground water and (2) the monitoring of extensive nonpoint sources of pollution instead of from discrete point sources. (Woodard-USGS)
W77-09995

GROUND-WATER RESOURCES OF THE LEXINGTON, KENTUCKY, AREA,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-09996

WATER QUALITY PROGRAM OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10006

1976 WATER-QUALITY DATA IN BEAR CREEK BASIN, MEDFORD, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10015

METHODOLOGY TO EVALUATE ALTERNATIVE COASTAL ZONE MANAGEMENT POLICIES: APPLICATION IN THE TEXAS COASTAL ZONE, SPECIAL REPORT III: A METHODOLOGY FOR INVESTIGATING FRESH WATER INFLOW REQUIREMENTS OF A TEXAS ESTUARY, VOL. I,
Texas Univ. at Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 2L.
W77-10022

OIL SPILL IDENTIFICATION SYSTEM.
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5A.
W77-10024

WATER COLOR AND CIRCULATION SOUTHERN CHESAPEAKE BAY. PART I. SOUTHERN CHESAPEAKE BAY WATER COLOR AND CIRCULATION ANALYSIS, PART II. SKYLAB MSS VS. PHOTOGRAPHY FOR ESTUARINE WATER COLOR CLASSIFICATION,
Virginia Inst. of Marine Science, Gloucester Point.
Applied Marine Science and Ocean Engineering
For primary bibliographic entry see Field 2L.
W77-10026

THREE-LAYER CIRCULATIONS IN ESTUARIES AND HARBORS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 2L.
W77-10030

OIL AND GAS SEEPS IN ALASKA. ALASKA PENINSULA, WESTERN GULF OF ALASKA,
Bureau of Mines, Anchorage, Alaska. Alaska Field Operation Center.
D. P. Blasko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 013, Price codes: A05 in paper copy, A01 in microfiche. Report of Investigations 8122, 1976. 83 p, 8 fig, 31 tab, 5 ref.

Descriptors: *Alaska, *Oil pollution, *Seepage, *Water pollution sources, *Baseline studies, Gases.
Identifiers: *Outer Continental Shelf, *Gulf of Alaska, Bitumen, Resources management.

The Bureau of Mines investigated two areas of the Alaska Peninsula (Iniskin Peninsula and Becharof Lake) where oil and gas seeps were known to occur in an attempt to determine (1) whether the seeps are still active and (2) the amount of bitumen contained in the drainage leaving the seeps. The oil, water, oil-water, and gas were sampled and analyzed. Five oil samples were taken at four separate oil seeps. The API gravity of the oil ranged from 8.9 to 21.4 degrees and the sulfur content was from 0.12 percent to 0.59 percent. Four of the seven gas samples obtained revealed fairly high calorific values, ranging from 746 to 924 Btu/cu ft, and averaging 844 Btu/cu ft. A total of 44 water samples were obtained. Bitumen content of the water was as high as 9,733 mg/l at one seep, but averaged less than 1 mg/l where the seep-drainage water entered the Gulf of Alaska. (Sinha-OEIS)
W77-10033

SIMULATION FACTORS INVOLVED IN OCEAN THERMAL POWER PLANTS,
Naval Academy, Annapolis, Md. Dept. of Naval Systems Engineering.
B. J. Wegner, and M. E. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-017 390, Price codes: A02 in paper copy, A01 in microfiche. August 1975. 21 p, 2 tab, 4 ref.

Descriptors: *Diffusion, *Nuclear powerplants, *Thermal powerplants, *Thermal pollution, Heat transfer, Dimensional analysis, Oceans.
Identifiers: *Ocean thermal powerplants, Thermal plumes, Energy balance.

The parameters which control the diffusion of heat from an ocean sited nuclear power plant are investigated. The relative severity of the thermal plume resulting from the utilization of sea water as a cooling medium for power plants, both fossil and nuclear fueled, has been somewhat of a controversial problem considered by various segments of society, ranging from engineers to fishermen and conservationists. In this study dimensional analysis is applied to identify dimensionless groups which are involved in the diffusion of heat from an ocean sited plant. The techniques of dimensional analysis and its usefulness are discussed. The energy balance for the system is introduced from which the parameters and factors which are most significant are correlated into dimensionless heat transfer groups. (Sinha-OEIS)
W77-10034

A DYNAMIC WATER QUALITY MODEL FOR THE NEUSE ESTUARY, N.C.,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
M. Ameen, and S. G. Wardak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 345, Price codes: A04 in paper copy, A01 in microfiche. Sea Grant Publication No UNC-SG-75-28, December 1975. 68 p, 8 fig, 3 tab, 21 ref. Sea Grant 04-3-158-40.

Descriptors: *Estuaries, *Water quality, *North Carolina, Mathematical models, Computer programs.
Identifiers: *Neuse estuary(NC).

The numerical model consists of two parts. The first part employs an implicit method for the solution of the shallow water hydrodynamic equations. The objective of this part of the work is to obtain the values of discharge, velocity and depth in the estuary under the action of freshwater inflow, surface runoff, winds and tides. The second part of the model uses an explicit method for the solution

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

of the unsteady mass-balance equation (equation of mass transport). The objective of this part of the work is to obtain values for concentration of materials in the estuary. The process can be steady or unsteady, the material can be conservative or non-conservative. Applications of the model to the Neuse Estuary are given and the model is tested with field data for ammonia, nitrates and dissolved oxygen. (Sinha-OEIS)
W77-10037

BAY SPRINGS LAKE WATER-QUALITY STUDY

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
S. C. Wilhelm.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 023. Price codes: A07 in paper copy, A01 in microfiche. Technical Report H-76-7, May 1976. 135 p, 22 fig, 64 plates, 12 ref, 2 append.

Descriptors: *Artificial watercourses, *Hydraulic models, *Simulation analysis, *Dissolved oxygen, *Water quality, *Mathematical models, *Inland waterways, *Synthetic hydrology, *Locks, *Navigation, *Stratified flow, *Water temperature, *Tennessee, *Reservoirs, *Mississippi, *Alabama, *Tennessee. Identifiers: *Tennessee-Tombigbee Waterway (Ala-Miss-Tenn), *Bay Springs Lake (Miss), *Tombigbee Waterway (Miss).

A laboratory investigation was made to predict expected temperature and dissolved oxygen content of water within and released from Bay Springs Lake, Mississippi, part of the projected extension of the Tennessee-Tombigbee Waterway from the existing Black Warrior-Tombigbee Waterway to the Tennessee Valley system. The location of proposed lock intakes was evaluated with respect to their ability to meet water quality requirements established by state environmental and wildlife agencies. Three models were used to investigate the mechanics of density-stratified flow within the lake as affected by inflow from the local drainage areas and the divide-cut canal and to predict the temperature and dissolved oxygen regime of the lake immediately upstream of the dam and in releases through the lock. An undistorted physical model was used to define steady-state withdrawal characteristics at the lock intakes and local topography. A highly-distorted-scale physical model was used to simulate the lake, the divide-cut canal and a local embayment, and to determine the response of the proposed lake to dynamic density-stratified flow. A mathematical model—WESTEX—was used to simulate daily variations in temperature and dissolved oxygen. The various simulations indicate that the proposed project will satisfy water quality considerations. (Harris-Wisconsin)
W77-10055

CALCIUM CARBONATE PRECIPITATION KINETICS, PART I, PURE SYSTEM KINETICS, Cape Town Univ. (South Africa). Dept. of Civil Engineering.

For primary bibliographic entry see Field 5F.
W77-10087

5C. Effects Of Pollution

A GUIDE TO AERATION/CIRCULATION TECHNIQUES FOR LAKE MANAGEMENT, Tetra Tech, Inc., Lafayette, Calif.
For primary bibliographic entry see Field 5G.
W77-09603

NUTRIENT DIVERSION: RESULTING LAKE TROPIC STATE AND PHOSPHORUS DYNAMICS

Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W77-09604

STUDIES ON THE RECLAMATION OF STONE LAKE, MICHIGAN,

Notre Dame Univ., Ind.
For primary bibliographic entry see Field 5G.
W77-09605

WASTEWATER TREATMENT BY NATURAL AND ARTIFICIAL MARSHES,

Wisconsin Univ., Oshkosh.
For primary bibliographic entry see Field 5D.
W77-09606

TEMPERATURE EFFECTS ON THE DENITRIFICATION PRODUCTS BY TWO AQUATIC PSEUDOMONAS SPECIES,

Y. K. Chan, and N. E. R. Campbell.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2674-2681, 1975. 7 fig, 12 ref.

Descriptors: *Denitrification, *Water temperature, *Bacteria, *Mode of action, *Canada, *Pseudomonas, *Nitrogen compounds, *Lakes. Identifiers: *Nitrous oxide, *Experimental Lakes Area (Canada).

Laboratory experiments dealt with two aspects of aquatic denitrification: (1) a comparison of the quantitative distribution of denitrification products over the growth temperature ranges between psychotrophic bacteria (able to grow at 5°C or less regardless of its optimum temperature range), and mesophilic (able to grow at a medium temperature) isolates of *Pseudomonas* from bottom sediments of a lake in the Experimental Lakes Area, Northwestern Ontario; and (2) an assessment of the contribution to denitrification by each species at various temperatures. Low temperature tends to retard the formation of intermediates and denitrification products, with rates dropping more slowly with decreasing temperature in the psychotroph and more rapidly in the mesophile. Accumulation of nitrate became most significant at low incubation temperatures for both species. The mesophile formed more nitrous oxide at 10 and 15°C than at the other temperatures used (5-30°C). The implication is that at temperatures of 10-15°C, which prevail in the lower portion of the thermocline during summer stratification in lakes where oxygen is limiting and nitrate is available, both *Pseudomonas* species contribute to denitrification in the water column, but only the mesophile is responsible for the nitrous oxide formation. Both the psychotroph and mesophile released dissolved molecular nitrogen as the end product. (Auen-Wisconsin)
W77-09607

METHANE OXIDATION IN A EUTROPHIC CANADIAN SHIELD LAKE,

J. W. M. Rudd, and R. D. Hamilton.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2669-2673, 1975. 2 fig, 4 ref.

Descriptors: *Methane, *Oxidation, *Biodegradation, *Anaerobic conditions, *Carbon, *Carbon dioxide, *Thermocline, *Eutrophication, *Bacteria, *Canada, *Lakes. Identifiers: *Experimental Lakes Area (Canada), *Methane oxidation.

The controlling factors of microbial methane oxidation, as a source of carbon and carbon dioxide, was investigated in a dimictic, eutrophic lake of the Experimental Lakes Area, northwestern Ontario, where large quantities of methane accumulate in the anaerobic bottom waters during summer and winter. The maximum oxidation rate closely follows the level of zero oxygen concentration from spring until early winter. However, as winter progresses the level of zero oxygen and maximum methane oxidation rate diverges with the level of maximum oxidation preceding the level of zero oxygen up the water column. It is concluded that the microorganisms responsible for the methane oxidation were microaerophilic and that they demon-

strate optimal activity at oxygen concentrations in the range between 0.1 and 1.0 ml/l. The field observations were confirmed by adding oxygen to exceed 1.0 mg/l which reduced the methane oxidation rate by about 40%; thus oxygen inhibition is the main controlling factor of methane oxidation. The methane oxidizing microorganism population is well adapted to its controlled niche and can efficiently scavenge methane down to less than 0.05 micromole; they are active at low temperatures (0.1°C) and operate optimally at oxygen concentrations of 0.1-1.0 mg/l. (Auen-Wisconsin)
W77-09608

AN ENERGY BALANCE FOR ALGAL POPULATIONS IN LIGHT-LIMITING CONDITIONS,

H. J. Gons, and L. R. Mur.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2729-2733, 1975. 2 fig, 5 ref.

Descriptors: *Trophic level, *Primary productivity, *Measurement, *Energy budget, *Algae, *Light intensity, *Limiting factors, *Growth rates, *Biomass, *Foreign research, *Estimating. Identifiers: Netherlands.

A mathematical method of measuring the relationship between production and algal absorption of light energy is proposed for a light-limited system, where production is dependent on the quantity of absorbed light energy, the conversion efficiency of light energy to energy used in cells, and the energy requirement for maintenance of cells. The method is based on chemostat cultures of *Scenedesmus protuberans*, maintained at 20°C, one illuminated by 30,000 J and the other by 13,000 J, with a diurnal light-dark cycle of 16 and 8 hours. All incidental light energy was absorbed when the cultures were in steady state. Production was measured from daily culture outputs, as biovolume (dry weight) and as heat of combustion, resulting in an energy balance which considered the light energy to be used for growth and maintenance of the alga. Maintenance energy was extrapolated from production data at various growth rates, resulting in a maintenance rate constant of 0.20/day. This concept of gross production allows comparisons of energy flows of different ecosystems, and is a useful parameter to describe the trophic condition of a system. Gross production is generally considered as the sum of net production and respiration, where in most cases net production and respiration are measured as gaseous exchange in order to fix a carbon balance. (Auen-Wisconsin)
W77-09609

MACROPHYTE-SEDIMENT RELATIONSHIPS

IN CHAUTAUGUA LAKE, S. A. Nicholson, R. A. Levey, and P. R. Clute.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2758-2764, 1975. 1 fig, 5 tab, 18 ref.

Descriptors: *Aquatic plants, *Spatial distribution, *Bottom sediments, *Particle size, *Lakes, *Clays, *Silt, *Sands, *Shallow water, *Turbulence, *New York, *Lake sediments. Identifiers: *Chautaugua Lake (NY), *Najas flexilis, *Anacharis canadensis, *Ceratophyllum demersum, *Myriophyllum, *Potamogeton crispus, *Potamogeton richardsonii, *Vallisneria spiralis, *Heteranthera dubia, *Macrophytes-sediment relationship.

How distribution of rooted macrophytes is influenced by sediment particle size was investigated in Chautaugua Lake, New York, by comparing communities of *Najas flexilis*, *Anacharis canadensis*, *Ceratophyllum demersum*, *Myriophyllum*, *Potamogeton* species, *Vallisneria spiralis* and *Heteranthera dubia* with sediments from several sites at similar depths. Partly because of water turbulence, macrophyte-sediment relationships were stronger at 1.5 m than at 2 m. The close relationship of weakly-rooted macrophytes

with substrate texture at 1.5 m also suggests that water activity influences macrophyte species distribution. The rather-indiscriminate distribution of strongly-rooted macrophytes with substrate points to the existence of other regulatory mechanisms. It is postulated that mechanisms which favor weakly-rooted macrophytes on fine textured (protected) sites may include differing tolerances to silting, varying uptake and release efficiencies, and the role of vitamins or allelopathic substances in poorly circulated waters. The experimental data clearly show that weakly-rooted macrophytes (*N. flexilis*, *A. canadensis*, *C. demersum*) were closely related to sediment character, particularly grain size, whereas other macrophytes were not. (Auen-Wisconsin)
W77-09612

THE PHYSICO-CHEMICAL LIMNOLOGY OF THE MWENDA RIVER MOUTH, LAKE KARIBA,
Rhodesia Univ., Salisbury. Dept. of Zoology.
A. P. Bowmaker.
Archiv für Hydrobiologie, Vol 77, No 1, p 66-108, 1976. 12 fig, 4 tab, 48 ref.

Descriptors: *Limnology, *Lakes, *Africa, *Reservoirs, Tributaries, Rivers, Physicochemical properties, Water pollution sources, Water pollution effects.
Identifiers: *Lake Kariba(Africa), Zambia, Rhodesia.

Effects of a fluvial estuary of the Mwenda River, typical of tributaries to Lake Kariba, on the Zambian-Rhodesian border, are described. The river mouth was partially covered by a floating *Salvinia molesta* mat which reduced oxygen during summer periods of minimal river discharge, deep within and below the mat. The Mwenda River enters man-made Lake Kariba as unde-, inter-, and overflows, depending on discharge volume. A local, shallow, periodically titled thermocline persisted throughout the year, above the overall lake summer thermocline. Oxyclines only developed in association with the overall thermocline. Nitrate-nitrogen concentrations were approximately ten times greater in the estuary than elsewhere in the lake. They are attributed to the possibility of the river receiving runoff nitrates from geological deposits in its catchment and to the high riverine concentrations of albuminoid nitrogen being deposited on the lake bottom, mineralizing to ammonia during the dry season, and oxidized to nitrate by the scouring action and high oxygen content of flood underflow. Described are the limnological development and characteristics of Lake Kariba, and its temperature and water quality (as well as that of the Mwenda River estuary and bay), seasonal changes in temperature and dissolved oxygen, its stratification, the chemical characteristics of its waters, and the water quality of different pools in the lake. (Auen-Wisconsin)
W77-09614

THE CONSEQUENCES OF IMPOUNDMENT ON AN ARCTIC CHAR LAKE SYSTEM. AN ANALYSIS BY SIMULATION MODELLING.
For primary bibliographic entry see Field 5B.
W77-09616

RATES OF TRANSPORT OF TOTAL PHOSPHORUS AND TOTAL NITROGEN IN MACKENZIE AND YUKON RIVER WATERSHEDS, N.W.T. AND Y.T., CANADA,
G. J. Brunskill, P. Campbell, S. Elliott, B. W. Graham, and G. W. Morden.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 3199-3203, 1975. 3 tab, 17 ref.

Descriptors: *Phosphorus, *Nitrogen, Rivers, Streams, Sampling, Velocity, *Watersheds(Basins), River flow, Erosion, Runoff, Precipitation(Atmospheric), Nitrogen fixation, Nutrients, *Canada.

Identifiers: *Transport rates, *Mackenzie River watershed(Canada), *Yukon River watershed(Canada), Non-point nutrient sources.

Transport rates were calculated from samples for particulate phosphorus (PP), particulate nitrogen (PN), total dissolved phosphorus (TDP), and total dissolved nitrogen (TDN) taken in 1971-74 on 11 streams and rivers in the Mackenzie River watershed, and a tributary to the Porcupine River in the Yukon River watershed. These transport rates calculations allowed comparison between large and small rivers and represent the flux of total nitrogen and total phosphorus from the watershed resulting from precipitation, mechanical and chemical erosion, and biological fixation and transport. The group of large rivers transported relatively large amounts of total nitrogen and total phosphorus per unit watershed area, and on the average there was a 1:1 ratio of TDN to PN, and about five times more PP than TDP. The group of small rivers transported relatively small amounts of total nitrogen and phosphorus with an average ratio of TDN to PN of 7 and TDP to PP of 1.8. These results indicate that: (1) higher concentrations of PP and PN, and greater runoff contribute to higher rates of transport of these elements in large rivers, (2) greater runoff contributes to higher rates of transport of TDP in these rivers, and (3) factors other than discharge or runoff contribute to TDN transport rates in the Mackenzie Valley. This data was found to cover the range of high and low values found in Temperate Zone watersheds. (Luedtke-Wisconsin)
W77-09617

AN INVESTIGATION OF THE ROLE OF ORGANIC MATERIALS IN FRESHWATER SYSTEMS,
J. E. Schindler, and J. J. Alberts.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2201-2206, 1975. 2 fig, 1 tab, 14 ref.

Descriptors: *Trace elements, *Humus, *Organic matter, *Lake sediments, *Chemistry of precipitation, Chemical reactions, Cation exchange, Oxidation-reduction potential, *South Carolina, Nuclear powerplants, Humic acids.
Identifiers: Par Pond(SC), Electron transport.

The type of distribution of humic materials in sediments and the extent of concentrations of trace elements associated with humus were studied in sediment cores from Par Pond, a cooling pond for nuclear reactors at the Savannah River Plant near Aiken, South Carolina. The total molar concentration of the cations in the alkali extracted fraction seemed related to the amount of organic material (as organic carbon) in the sediments. Early sediments showed relatively high redox potentials, which indicate a lack of reducing activity. However, the low redox potential and the increase in the amount of Fe and Mn in the acid extracts suggests that increased inorganic deposition had occurred, resulting in increased sulfide generation. Indications were that humic compounds are also capable of accepting as well as donating electrons; thus humics behave similarly to flavo-proteins in the electron transport processes with metals, serving as temporary electron acceptors in the sediments. Results indicated that sedimentary humic materials are relatively unimportant in the burial of cations but they may function as an intermediate electron transport system within anoxic sediments that may reduce metals such as iron and mercury. (Auen-Wisconsin)
W77-09618

MELOSIRA GRANULATA (EHR.) RALFS: MORPHOLOGY AND ECOLOGY OF A COSMOPOLITAN FRESHWATER DIATOM,
S. S. Kilham, and P. Kilham.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2716-2721, 1975. 2 fig, 1 tab, 16 ref. NSF GB-8328, NSF GB-41315.

Descriptors: *Diatoms, *Plant morphology, *Systematics, *Phylogeny, Plant ecology, *Africa, Lakes.
Identifiers: *Melosira granulata, Melosira granulata jonesis, Melosira granulata angustissima, *Lake Mulehe(Uganda).

Melosira granulata (Ehr.) Ralfs is shown to be simply a larger form of *M. granulata jonesis* (Grun.) and *M. granulata angustissima* (O. Muller). The ecological conditions that contribute to its abundance and distribution were investigated in East and Central African lakes. *M. granulata* was isolated from Lake Mulehe, Uganda, and germinated in a mud sample that had been stored for one year, then maintained in unialgal culture. The clone had the characteristics of *M. granulata angustissima*. Auxospores produced in the cultures were isolated and the resulting auxospore clones produced diatoms with the characteristics of *M. granulata*. During size reduction these auxospore clones passed through the varietal sequence of *M. granulata* to *M. granulata jonesis* to *M. granulata angustissima*, indicating that these varieties are simply different morphological forms in the *M. granulata* life cycle. Its distribution and proliferation usually occurs in mesotrophic waters with alkalinities of less than 8 meq/l, pH less than 9.0 conductivities less than 600 micromhos/cm, silicon dioxide greater than 5-10 mg/l, and that are shallow and well-mixed. (Auen-Wisconsin)
W77-09619

INTENSIVE LARGE CITY INFLUENCE ON REED-BANKS, (IN GERMAN),
Technische Universität, Berlin (West Germany). Inst. of Ecology.
H. Sukopp, B. Markstein, and L. Trepl.
Beitr Naturkd Forsch Suedwestdtsch 34, p 371-385, 1975.

Descriptors: *Aquatic algae, Vegetation, Lakes, *Sewage disposal, Eutrophication, Cities, Urbanization, Water level fluctuations, Water pollution sources, Water pollution effects.
Identifiers: *West Germany, Phragmites, *Scolochloa festuacea*, *Urtica kioviensis*, *Tegler Lake(Germany), *Reed-banks(Lakes), *Havel Lake(Germany).

The bank vegetation of Havel and Tegler Lakes (West Germany) was mapped in 1962, 1967 and 1972. The present natural characteristics of this area are described in detail. The reed-banks of the Berlin Havel area are distinguished in the north by *Scolochloa festuacea* and in the south by *Urtica kioviensis*. The Havel Lakes receive the effluent from the Berlin sewage disposal system. The lakes are released for general use as waters of the 1st order. Changes in the reed-banks, especially with reference to longitudinal and surface extensions over 1962-1972, are described. Some of the causes responsible for these changes are changes in water level, boat traffic, shoreline construction, bathing, alluvial material, eutrophication and its effects on Phragmites and algae.
W77-09621

EXPERIMENTS ON THE EFFECTS OF INORGANIC ENRICHMENT OF RIVERS ON PERIPHYTON PRIMARY PRODUCTION,
K. Wuhrmann, and E. Eichenberger.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2028-2034, 1975. 1 fig., 6 tab., 8 ref.

Descriptors: *Primary productivity, *Rivers, *Eutrophication, *Inorganic compounds, *Periphyton, Phosphates, Nitrites, Nitrates, Sessile algae, *Trace elements, *Metals.

Laboratory channels were used to simulate lotic environments to determine whether under ecologically-equal chemical and physical conditions eutrophication can occur in rivers, i.e., enhancement of primary production by increases of inor-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

ganic nitrogen, phosphorus concentrations, and other factors. Enrichment with inorganic nitrogen, and phosphates (500-700 microgram/l and about 8 microgram/l, respectively) produced no significant effect, as the natural concentrations of about 650 microgram nitrate/l and about 15 microgram phosphate/l already permitted unlimited growth. Nor did the enrichment have any significant influence on the periphyton species composition. Additions of presedimented sewage in 1/2000 and 1/4000 vol/vol increased biomass about 100% and 300%, but it is unlikely that the accelerated production was due to increased dissolved N and P, since the additions represented about 5 and 25 microgram N/l and 1.5 to 7 P/l. The community composition was unaffected by these additions despite the enhanced productivity. Increases of about 10 to 20% of trace elements remarkably accelerated biomass buildup and changes in community structure, but higher additions inhibited growth. No conclusions as to the effects of trace metals on primary productivity and community structure of the sessile algae in rivers are proposed on the basis of these experiments. (Auen-Wisconsin). W77-09625

GROWTH AND PHOTOSYNTHESIS DURING THE FORMATION OF A BENTHIC ALGAL COMMUNITY.

E. Eichenberger, and K. Wuhrmann. Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2035-2042, 1975. 5 fig., 1 tab., 1 ref.

Descriptors: *Rivers, *Benthic flora, *Succession, *Photosynthesis, Laboratory tests, Model studies, Analytical techniques, Measurement, Primary productivity.

Colonization and succession of benthic algae in artificial rivers is detailed and the harvest method is compared with the oxygen balance determination. Photosynthetic activity throughout four months of observation followed fluctuations in standing crop. However, the structure of the biocenosis affected the intensity of oxygen exchange in several ways: A dense growth depressed activity per unit weight. This effect of biomass is clearly depicted when the daily photosynthesis is plotted against illumination. When the biomass is larger, the light intensity required for photosynthesis saturation is less, suggesting that photosynthesis is limited by the exchange between organisms and the surrounding medium. The mechanism involved may affect photosynthesis directly or, alternatively, by a growth reduction which as a consequence may lead to an accumulation of substrate within cells and thus inhibit carbon fixation. In the channel biocenosis the ratio of extinctions of the pigment extract at 420 and 663 nm reflected the sociological composition. The data suggest a greater activity per unit biomass in an ecology with a lower extinction ratio, being presumably richer in green algae. It was evident that even when the biomass is decreasing at a fast rate, a high photosynthetic activity is maintained. This observation is of considerable importance in the selection of methods to determine productivity in running waters. (Auen-Wisconsin). W77-09627

DIATOMS IN POND PLANKTON: RELATIONSHIPS TO EPIPHYTIC AND EPIPELIC POPULATIONS.

W. J. Clark, and W. C. Runnels. Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2722-2728, 1975. 2 fig., 2 tab., 10 ref.

Descriptors: *Diatoms, *Plant populations, *community development, *Ponds, *Distribution, *Texas, Niches, Periphyton, Varieties, Benthos, Sessile algae, Plant morphology, Systematics, Artificial lakes, Lakes. Identifiers: *Fish Lake(Texas), *Parsons Lake(Texas), *Fields Lake(Texas).

Studies of diatom populations in three small artificial ponds in Brazos County, Texas, confirm evidence that the classical bimodal phytoplankton cycle is not operative in small lakes and provide additional evidence of the complexity of the interactions between planktonic, epiphytic and epipellic habitats. The results reinforce other evidence that there are no taxonomically-defined diatom phytoplankton in minor lakes with the presently constituted taxa. The same species exist in separate epiphytic and planktonic populations which react independently of each other. Despite the limnological similarity of the ponds, the relative importance of the three habitats for a given species varied considerably. Some species such as *Synedra ulna*, *S. rumpens*, *Navicula pennata*, *N. gregaria*, *Cymbella ventricosa*, were common in all three ponds. Others, such as *Pinnularia braunii*, *P. major* and *Synefra* acus were absent from one or two ponds. In no case did the epiphytic maxima coincide with the major mid-winter plankton pulse. The only consistence was that very large pulses, when they occurred, came in mid-winter. Unanswered are the questions: why similar ponds in the same area take such significantly different paths in their population structures and dynamics, and the nature of the phytoplankton and their relationship to the epiphytic and benthic or epipellic habitats. Several theories are discussed. (Auen-Wisconsin). W77-09628

ANALYSIS OF THE POPULATION DYNAMICS OF OSCILLATORIA REDEKEI VAN GOOR IN LAKE EDEBERG.

M.-E. Meffert. Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2682-2688, 1975. 2 fig., 1 tab., 17 ref.

Descriptors: *Algae, *Carbon dioxide, Nuisance algae, Growth rates, Europe, Population, Carbon cycle, Plankton, Inhibition, On-site investigations, Plant physiology, Cytological studies, Lakes, Systematics, Lakes. Identifiers: *Oscillatoria redekei, *Lake Edeberg(Germany), Cell lysis.

The population dynamics of *Oscillatoria redekei* were investigated both in laboratory experiments and in-situ at beta-mesosaprobic Lake Edeberg, Germany, to determine the specific conditions that cause a biomass decrease in this species. Results indicated that carbon dioxide deficiency induces trichome fragmentation and cell lysis in this alga and that the carbon dioxide concentration causing lysis varies with light intensity. In the lake, the growth pattern was defined as follows: Up to pH 9, with a regular carbon dioxide supply, the algae grow rapidly without fragmentation or lysis. When a carbon dioxide deficiency occurs above pH 9, the cell numbers per trichome decrease. During the fragmentation phase the concentration of free carbon dioxide was always below 10 micromol/l and frequently below 5 micromol/l. The origin, duration, and extent of fragmentation and lysis depend on the extent of carbon dioxide deficiency and the duration of good weather conditions. The decrease in the number of carbon-fixing organisms causes an increase in carbon dioxide concentration, which, in turn, induces renewed growth. A carbon dioxide deficiency causes a decrease in biomass but not a total destruction of the *Oscillatoria* population. (Auen-Wisconsin). W77-09629

A FOOD WEB MODEL FOR LAKE MICHIGAN: PART I-JUSTIFICATION AND DEVELOPMENT OF THE MODEL.

Michigan Univ., Ann Arbor. Dept. of Civil Engineering. A. H. Vogel, and R. P. Canale. Available from the National Technical Information Service, Springfield, VA 22161 as COM-75-11185. Price codes: A03 in paper copy, A01 in microfiche. MICHU-SG-74-203 (Sea Grant

Technical Report 40), March 1974. 61 p. 5 fig., 59 ref. SG 04-3-158-23.

Descriptors: *Lake Michigan, *Model studies, *Fish management, *Water quality control, *Food webs, Methodology, Trophic level, Eutrophication, Phytoplankton, Zooplankton, Computer models, Nutrients. Identifiers: Alewife.

Biological, chemical and physical aspects are presented for a lower trophic level model being developed to provide guidance for the effective management of water quality and fisheries production in Lake Michigan. Justification of why such a model is necessary, the methods of approach, the nature of the model, the availability of data, and its uses and limitations are discussed. It is concluded that it is feasible to develop an effective modelling methodology and that it is: (1) required as a first step toward defining optimal resource management, (2) will facilitate the testing of hypotheses concerning biological mechanisms in Lake Michigan, and (3) will be useful to pinpoint specific areas where research is necessary to the understanding of the limnological processes. A highly complex model is required because eutrophication effects on the fisheries are plankton-taxon specific and also to predict the effects of the introduction of new fish species such as the alewife invasion. Present model equations account for separate phytoplankton and zooplankton taxa, major nutrient chemical species, detrital components, the alewife, and age groupings within the alewife and zooplankton populations. It is recommended that a single computer system be used for the storage and retrieval of all Lake Michigan limnological data and that a comprehensive plan be established to define needs of data gathering programs. (Luedtke-Wisconsin). W77-09631

CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY.

Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5A. W77-09634

EFFECT OF ORGANIC EXCRETION BY BENTHIC ANNELIDA ON THE PRODUCTIVITY OF PHYTOPLANKTON.

Institut Oceanographique, Paris (France). Laboratoire de Physiologie des Etres Marins. J. C. Lacaze, and O. V. de Naide. Internationale Revue der gesamten Physiologie vol 62, no 1, p. 153-155, 1977 1 fig., 5 ref.

Descriptors: *Phytoplankton, *Marine benthos, Growth rates, *Marine algae, Marine biology, Benthos, *Primary productivity, Bioassay, Laboratory tests, Estuarine environment, Herbicides, Animal physiology, Benthic fauna, *Annelids, Pollutant identification. Identifiers: *EDTA, *Growth inhibition, *Polychaetes, Excretory products, Paronis, *Rance estuary(France).

The incorporation of an organic chelating agent (EDTA) in water containing the benthic polychaete *Sabella paronisi* for 16 hours causes an increase of 25% in primary production. This observation supports the hypothesis that the waste products of these organisms inhibit phytoplankton productivity. (Katz) W77-09660

COMPETITION FOR MERCURY BETWEEN RIVER SEDIMENT AND BACTERIA.

Ottawa Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 5B. W77-09661

RENAL EXCRETION IN CHANNEL CATFISH FOLLOWING INJECTION OF QUINALDINE SULPHATE OR 3-TRIFLUOROMETHYL-4-NITROPHENOL

Fish and Wildlife Service, La Crosse, Wis. Fish Control Lab.
J. L. Allen, and J. B. Hunn.
Journal of Fish Biology, vol 10, no 5, 1977, p. 473-479 4 tab., 18 ref.

Descriptors: Channel catfish, *Fish physiology, *Animal pathology, *Sodium, *Potassium, *Calcium, *Magnesium, *Chlorides, Laboratory tests, Water pollution effects, *Pesticides, Methodology, Pollutant identification. Identifiers: Ictalurus, *Quinaldine sulphates, *3-trifluoromethyl-4-nitrophenol, *Kidney function, *Renal excretion, Urine collection techniques, *TFM.

Channel catfish, *Ictalurus punctatus* Rafinesque, injected intraperitoneally with 2-methyl-quinoline sulphate (QdSO₄) or 3-trifluoro-methyl-4-nitrophenol (TFM) eliminate most of the dose of these compounds by extra-renal routes. Patterns of renal excretion of Na⁺, K⁺, Ca²⁺, Mg²⁺, and Cl⁻ (uEq kg⁻¹) appeared to be associated with the 'stress' of the urine collection technique rather than with the elimination of either compound. Concentrations of Na⁺, K⁺, Ca²⁺, Mg²⁺, and Cl⁻ (mEq/l) were determined in urine, plasma and gall bladder bile. (Katz).
W77-09662

THE TOXICITY OF SODIUM PENTACHLOROPHENOLATE FOR THREE SPECIES OF DECAPOD CRUSTACEANS AND THEIR LARVAE

Amsterdam Univ. (Netherlands). Pharmacological Lab.
J. J. van Dijk, C. van der Meer, and M. Wijnans.
Bulletin of Environmental Contamination and Toxicology, vol 17, no 5, p. 622-630, 1977 5 tab, 18 ref.

Descriptors: *Toxicity, Bioassay, Methodology, Laboratory tests, *Crustaceans, *Shrimp, Growth stages, Juvenile growth stage, Water pollution effects, Statistical methods, Water temperature, Salinity, *Herbicides. Identifiers: Biocide, *Decapod crustaceans, *Crangon, *Palaeomon, *Palaeomonetes, First instar larvae, Dose-mortality data, *Sodium pentachlorophenolate, Moulting.

The toxicity of sodium pentachlorophenolate for two marine decapods, *Crangon crangon* and *Palaeomon elegans* and a brackish water decapod, *Palaeomonetes varians* has been compared using adults as well as first instar larvae. Among the adults, *Crangon* was the most sensitive; among the first instar *Crangon* and *Palaeomonetes* were equally sensitive and *Palaeomonetes* was most tolerant. (Katz).
W77-09663

PLANKTON ECOLOGY IN LONG POND, ST. JOHNS, NEWFOUNDLAND: A POLLUTED POND CHARACTERIZED BY A HIGH FLUSHING RATE

Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
M. F. O'Connell, and C. W. Andrews.
Internationale Revue der Gesamten Hydrobiologie, vol. 62, no 1, p. 133-152, 1977 6 tab., 12 fig., 35 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Ponds, *Domestic wastes, Dominant organisms, Agricultural runoff, Agricultural watersheds, *Primary productivity, *Nannoplankton, *Eutrophication, Ecosystems, On-site-investigations, Nutrients, Daphnia, Phosphates, Nitrates, *Canada. Identifiers: *Long Pond(St. Johns, Newfoundland), High flushing rate, Seasonal distribution,

Oscillatoria, Diatomia, Tabellaria, Synura, Ulothrix, Spirogyra, Trachelomonas, Cryptomonas, Chlamydomonas, Ciliates, Bosmina, Epischura, Diaptomus, Sub-dominant zooplanktons.

Plankton was studied seasonally and quantitatively in Long Pond, St. John's, Newfoundland. This pond receives both rural and urban runoff and is characterized by a high flushing rate. A comparison is made with Clarkes Pond, Hogans Pond and Bauline Long Pond. Long Pond phytoplankton was characterized by nannoplankton (particularly flagellated forms). The most important zooplankters were *Bosmina coregoni* and *Daphnia catwaba*. Aspects of plankton ecology are discussed in relation to eutrophication and water renewal. (Katz)
W77-09664

THE EFFECT OF TRICAIN METHANESULPHONATE (MS-222) ON THE MICROHAEMATOCRIT OF FISH BLOOD

Randse Afrikaanse Universiteit, Johannesburg (South Africa). Dept. of Zoology.
J. Hattingh.
Journal of Fish Biology, vol. 10, p. 453-455, 1977 1 fig, 10 ref.

Descriptors: *Fish behavior, *Fish diseases, Animal pathology, Freshwater fish, Bioassay, Laboratory tests, Water pollution effects, Methodology, Carp, Fish toxins, Fish physiology, *Pollutant identification. Identifiers: *Tricaine methanesulphonate, *Fish blood, *Microhaematocrit, Fish anaesthetics, Haemolysis, Labeo, Barbus.

The effects of the anaesthetic, MS-222, on the haematocrit value of freshwater fish have been examined. Blood containing MS-222 showed a higher haematocrit value than blood without the anaesthetic and haemolysis occurred in the former after a variable time depending on the concentration. The results are discussed in relation to previous findings. (Katz)
W77-09665

THE EFFECT OF PARASITISM ON THE TOXICITY OF CADMIUM TO THE THREE-SPINED STICKLEBACK, GASTEROSTEUS ACULEATUS L.

University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
D. Pascoe, and P. Cram.
Journal of Fish Biology, vol. 10, no. 5, p. 467-472 1977. 2 tab, 2 fig, 21 ref.

Descriptors: *Cadmium, *Toxicity, Bioassay, Laboratory tests, *Parasitism, *Sticklebacks, Fish physiology, *Animal pathology, Water quality, Water pollution effects, Methodology, Pollutant identification. Identifiers: *Toxic mechanism, *Parasitic infection, *Tapeworm, Cestode, Schistocephalus, Static toxicity, Test, *Continuous flow, Toxicity test, Median period of survival, Mean parasitic index.

The toxicity of cadmium to sticklebacks was determined over a wide range of concentrations. The 96 h LC50 was 6.5 mg Cd l⁻¹. The shape of the time-concentration curve suggests that cadmium may have two toxic mechanisms. The median period of survival for fish infected with the plerocercoids of the cestode, *Schistocephalus solidus*, was considerably shorter than for non-parasitized fish. This observation is considered in the light of the known effects of *S. solidus* on its host. (Katz)
W77-09666

MERCURY ACCUMULATION BY LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN RECENTLY IMPOUNDED RESERVOIRS

Clemson Univ., S.C. Dept. of Environmental Systems Engineering.

A. R. Abernathy, and P. M. Cumbie.
Bulletin of Environmental Contamination and Toxicology, vol. 17, no. 5, p. 599-601, 1977 6 tab, 20 ref.

Descriptors: *Mercury, *Bass, Freshwater fish, Path of pollutants, Water pollution effects, On-site-investigations, *South Carolina, Hydroelectric power, *Impoundments, *Impounded waters, *Metals, *Oligotrophic, Sediments, Water quality, Eutrophication. Identifiers: *Lake Hartwell(SC), *Lake Keowee(SC), *Lake Jocassee(SC), Multipurpose hydroelectric impoundment, Micropterus, *Tissue mercury concentrations, Axial muscle.

Mercury levels of largemouth bass from three reservoirs in the southeastern United States were highest in bass from the younger, relatively oligotrophic reservoirs and were significantly lower in bass from an older, more eutrophic reservoir in the same drainage system. The reservoir with the highest mercury levels in bass is the reservoir farthest upstream, and is not subject to inputs of municipal or industrial wastes. The source of mercury in these reservoirs appears to be the soil which formed their original sediments. Preliminary data indicate that mercury levels in largemouth bass in these systems decline as the reservoirs age. Elevated mercury levels in fish appear to be a transitory phenomenon in newly impounded, relatively oligotrophic reservoirs. (Katz)
W77-09667

TOXICITY OF HYDROGEN SULFIDE TO VARIOUS LIFE HISTORY STAGES OF BLUEGILL (LEPOMIS MACROCHIRUS)

Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
L. L. Smith Jr., D. M. Oseid, G. L. Kimball, and S. M. El-Kandelgy.
Transactions of the American Fisheries Society, vol. 105, no. 3, p. 442-449, May 1976. 8 tab, 10 ref.

Descriptors: *Toxicity, *Lethal limit, *Fish reproduction, Water pollution effects, *Hydrogen sulfide, Environmental effects, *Bioassay, Feeding rates, *Growth rates, *Growth stages, Longevity, Mortality, Fish eggs, Sulfides, *Life history studies, Laboratory tests, *Sunfishes, Fry, Juveniles, Pollutant identification. Identifiers: *Sublethal effects.

Bluegill (*Lepomis macrochirus*) eggs, fry, juveniles, and adults were exposed to hydrogen sulfide concentrations to determine acute toxicity. For eggs, 72-h LC50 was 0.0190 mg/liter; 96-h LC50 for 35-day-old fry was 0.0131 mg/liter, for juveniles 0.0478 mg/liter and for adults 0.0448 mg/liter. Exposure to lower levels of hydrogen sulfide resulted in some acclimation. No egg deposition occurred after long-term exposure to 0.0022 mg/liter hydrogen sulfide and reduced deposition was observed after 97 days at 0.0010 mg/liter. Growth was adversely affected at levels from 0.0031 to 0.0107 mg/liter hydrogen sulfide depending on the life history stage at which chronic exposure was started. When exposure was started with eggs, the lower level retarded growth. Time to anesthesia with MS-222 was reduced at levels from 0.0014 to 0.0031 mg/liter hydrogen sulfide. The most sensitive stage to acute toxicity was the feeding fry and to chronic toxicity was the spawning adults. (Katz)
W77-09668

IMMEDIATE BEHAVIORAL REACTIONS OF BLACKNOSE DACE, RHINICHTHYS ATRATULUS, TO DOMESTIC SEWAGE AND ITS TOXIC CONSTITUENTS

Maryland Univ., College Park. Inland Environmental Lab.
J. A. Fava, and C. F. Tsai.
Transactions of the American Fisheries Society, vol. 105, no. 3, p. 430-441, May 1976. 5 tab, 3 fig, 24 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Domestic wastes, *Chlorine, *Fish behavior, Environmental effects, *Nitrogen compounds, *Sewage, *Toxins, Laboratory tests, Ammonia, Ammonium salts, Freshwater fish, Water pollution effects, Methodology, Stress.

Identifiers: *Avoidance reactions(Fish), *Chloramine, *Rhinichthys, *Dace.

Using a channelled avoidance trough, immediate behavioral reactions of Blacknose dace to a domestic sewage effluent and its toxic constituents, chloramines, free chlorine, and ammonia, were investigated. Two avoidance indexes were computed from time spent and number of entries by fish into a test solution channel and a clean water channel. On the basis of the time avoidance index, the more sensitive of the two, the fish did not avoid unchlorinated sewage effluent and ammonium chloride solution in concentrations as high as 270 mg/liter as ammonia-nitrogen. The fish did avoid chlorinated sewage effluent, chloramines, and free chlorine. The degree of fish avoidance increased as total chlorine content increased. The threshold avoidance concentration under test conditions was 0.13 mg/liter as total chlorine for chlorinated sewage effluent, 0.18 mg/liter for chloramines, and 0.61 mg/liter for free chlorine. The degree of fish avoidance and the pattern of behavioral responses to chlorinated sewage effluent were almost identical with those to chloramines but different from those to free chlorine. These results suggest that chloramines are the major factor causing avoidance reaction of blacknose dace to chlorinated sewage effluent. (Katz)

W77-09669

THE TOXICITY OF MALATHION AND ITS HYDROLYSIS PRODUCTS TO THE EASTERN MUDMINNOW, UMBRA PYGMAEA (DEKAY). Rutgers - The State Univ., New Brunswick, N. J. M. E. Bender, and J. R. Westman. Chesapeake Science, Vol. 17, No. 2, p 126-128, July 1976. 4 tab., 15 ref.

Descriptors: *Toxicity, *Pesticides, *Lethal limit, *Organophosphorus pesticides, *Insecticides, Persistence, Hydrolysis, *Mortality, Water pollution effects, Freshwater fish, *Bioassay, Laboratory tests, Water quality, Chemical degradation, Pollutant identification.

Identifiers: *Malathion, *Mudminnows, Umbra pygmaea.

The toxicity of malathion and its major hydrolysis products to the eastern mudminnow, Umbra pygmaea, was determined by utilizing 4-day static toxicity tests and 14-day continuous flow tests. Four-day LC50 values in mg/l were as follows: malathion .24; dimethylphosphorodithioic acid 17; diethyl fumarate 8.5; 2-mercaptodiethylsuccinate 47 and dimethylphosphorothionic acid 26. The basic hydrolysis products were more toxic than the acid hydrolysis products; 14-day continuous flow tests were conducted only on malathion and the basic hydrolysis products. Calculations of field application rates for the pesticide reviewed in light of the toxicity results suggest that only the parent compound, malathion, poses an environmental hazard to the mudminnow. (Katz)

W77-09670

ATP CONTENT AND MORTALITY IN MYTILUS EDULIS FROM DIFFERENT HABITATS IN RELATION TO ANAEROBIOISIS. Utrecht Rijksuniversiteit (Netherlands), Lab. of Chemical Animal Physiology. T. C. M. Wijsman. Netherlands Journal of Sea Research, Vol. 10(1), p. 140-148, 1976. 3 fig, 22 ref.

Descriptors: *Mussels, Biochemistry, *Anaerobic conditions, Environmental effects, Habitats, *Aerobic conditions, Aquaculture, *Mortality, *Metabolism, Animal physiology, Laboratory tests, Respiration, Shellfish farming, Crustaceans,

Energy, Energy budget, Oxygen, Water pollution effects.

Identifiers: *ATP, *Mytilus edulis.

Mortality and ATP content during experimental exposure to air were determined in two groups of Mytilus edulis, a wild group which is dry during low tide and a cultured group which is continuously covered by sea water. When kept in sea water, ATP levels were 2.02 plus or minus 0.14 mM in cultured and 2.08 plus or minus 0.09 mM in wild mussels. In mussels exposed to air for 7 days, a maximum decrease in ATP content to 1.18 mM (cultured) and 0.94 mM (wild) was determined after 3 days. Mortality in wild mussels reached 9% and stopped after reimmersion in sea water, whereas mortality in cultured animals was 24% at the end of exposure and continued under aerobic conditions, being 50% after 4 days of aerobiosis. Normal ATP levels were restored after 2 to 3 days of aerobiosis in both groups. When mussels were exposed to air and immersed in sea water alternately for periods of 24h, ATP levels were maintained at about 1.4 mM for cultured and 1.2 mM for wild animals. Mortality did not exceed control levels. (Katz)

W77-09671

TOXIC ACTION OF SEVERAL LETHAL CONCENTRATIONS OF AN ANIONIC DETERGENT ON THE GILLS OF THE BROWN TROUT (SALMO TRUTTA L.). Aston Univ., Birmingham (England). Dept. of Biological Sciences. P. D. Abel. Journal of Fish Biology, Vol. 9, p. 441-446, 1976. 4 fig., 1 tab., 24 ref.

Descriptors: Water pollution effects, *Detergents, *Mortality, *Fish diseases, *Brown trout, Animal pathology, *Cytological studies, *Toxicity, Toxins, Anions, Microscopy, Laboratory tests, Salmonids, Fish physiology, Respiration, Phosphates, *Pollutant identification, *Electron microscopy.

Identifiers: *Cell lysis, *Sodium lauryl sulphate, *Gill damage, *Histology, Anionic detergent.

The pathological effects of ten lethal concentrations of the anionic detergent, sodium lauryl sulphate, on the gills of Salmo trutta have been studied by light and electron microscopy. At concentrations to 120 mg/l (medium survival times greater than 1 hour), epithelial cell death is associated with lysosome formation. Acute inflammation of the gill tissue, extensive detachment of the epithelium and, except at the lowest concentrations, collapse of the pillar cell system occur. At concentrations above 120 mg/l (medium survival times less than 1 hour) very rapid lysis of cells results in the complete disruption of cellular and tissue structure. Review of the biomedical literature suggests the observed effects of sodium lauryl sulphate on gill cells correspond to the two mechanisms by which detergents cause death in isolated cells. These are lysis by the action of the cell's own enzymes, induced by an initial lesion in the cell membrane whose precise nature is not known; and rapid lysis by the direct action of the detergent on the cell constituents. (Katz)

W77-09672

HISTOPATHOLOGIC ALTERATIONS IN SHELL GLAND ACCOMPANYING DDT-INDUCED THINNING OF EGG SHELL. Army Veterinary Corps, Aberdeen Proving Grounds, Md. Veterinary Pathology Biomedical Labs. G. T. Kolaja, and D. E. Hinton. Environmental Pollution, Vol. 10, p. 225-231, 1976. 5 fig., 1 tab., 13 ref.

Descriptors: *DDT, *Path of pollutants, *Mallard ducks, *Reproduction, *Water bird, *Animal pathology, *Waterfowl, *Bird eggs, Pesticides, Chlorinated, Hydrocarbon pesticides, Cytological studies, Laboratory tests, Microscopy, Calcium.

Identifiers: *Eggshells, *Histology.

Eggshell gland morphology was studied in control and DDT-treated (75ppm) mallard ducks. Histopathologic alterations in DDT-treated ducks included edema of villous projections, pyknosis of glandular epithelium, and cytoplasmic vacuolation of lining epithelium. These alterations accompanied DDT-induced thinning of eggshells. Eggshells of DDT-treated ducks were 13.8% thinner than those from controls. Edema in the shell gland may cause decreased calcium transport, a possible cause of eggshell thinning. W77-09673

ECOLOGICAL RESPONSES OF PHYTOPLANKTON ON CHRONIC OIL POLLUTION. Democritus Nuclear Research Center, Athens (Greece). Dept. of Biology. L. Ignatiades, and N. Mimicos. Environmental Pollution, Vol. 13, p. 109-118, 1977. 2 fig., 5 tab., 38 ref.

Descriptors: *Biological communities, Water pollution effects, *Phytoplankton, *Marine microorganisms, *Diatoms, *Dinoflagellates, *Cyanophyta, *Oil wastes, Oil pollution, *Toxicity, On-site investigations, Seasonal, Annual succession, Productivity, Aquatic microorganisms, Bays.

Identifiers: *Sublethal effects, *Elefsis Bay(Aegean Sea).

The composition of phytoplankton in an inshore environment constantly polluted by petroleum hydrocarbons was followed over an annual cycle. The diatoms, dinoflagellates, micro-flagellates, coccolithophores, silico-flagellates, blue-greens, and others seemed to resist the toxicity of oil at recorded concentrations (14.90-21.85 mg/liter near surface and 11.90-27.00 mg/liter near bottom, total hydrocarbons). Special attention was paid to the species composition, dominance, diversity, and succession of diatoms and dinoflagellates. The results are compared with data obtained from other nonpolluted environments and the relationships discussed. It is recommended that such factors as grazing, biodegradation, temperature, and nutrients be taken into consideration when laboratory data are used to interpret corresponding phenomena in nature. (Katz)

W77-09674

THE EFFECT OF MIREX ON THE BURROWING ACTIVITY OF THE LUGWORM (ARENICOLA CRISTATA). Environmental Research Lab., Gulf Breeze, Fla. W. P. Schoor, and S. M. Newman. Transactions of the American Fisheries Society, vol. 105, no. 6, p. 700-703, 1976. 2 fig., 2 tab., 7 ref.

Descriptors: Path of pollutants, *Pesticides, *Chlorinated hydrocarbon pesticides, *Adsorption, *Benthic fauna, Animal behavior, Water pollution effects, Benthos, Invertebrates, Laboratory tests, Analytical techniques, Gas chromatography, Feeding rates, Bottom sediments, Worms, *Bioassay, Pollutant identification.

Identifiers: *Arenicola, *Lugworm, *Mirex, Arenicola.

An inexpensive bioassay system was developed to estimate pollutant effects on a benthic animal. Mirex, a fire ant toxicant, was taken into the substrate by the burrowing and feeding activity of the lugworm, Arenicola cristata, and significantly affected this activity. Mirex was present in the adult worm as well as in its juvenile stage. (Katz)

W77-09675

ORGANCHLORINE PESTICIDES AND PCBs DISTRIBUTION IN TISSUES OF PURPLE

HERON AND SPOON DUCK FROM THE BIOLOGICAL RESERVE OF DONANA (SPAIN), Consejo Superior de Investigaciones Científicas, Madrid (Spain). Instituto de Química Orgánica General.
For primary bibliographic entry see Field 5A.
W77-09677

ACCOMMODATION OF DAPHNIA PULEX TO ALTERED PH CONDITIONS AS MEASURED BY FEEDING RATE, Kansas Dept. of Health and Environment, Topeka.
R. L. Kring, and W. J. O'Brien.
Limnology and Oceanography, Vol. 21, No. 2, p 313-315, 1976. 1 fig., 13 ref.

Descriptors: Environmental effects, *Feeding rates, *Daphnia, *Hydrogen ion concentration, *Water temperature, Animal behavior, Laboratory tests, *Crustaceans, Water quality, Temperature, Zooplankton, Water pollution effects.

The maximal feeding rate of cladoceran populations occurs at or near the temperature and pH at which the animals were raised, suggesting that cladocerans may be able to alter their maximal feeding rates upon prolonged exposure to different conditions. Feeding rates of a population of *Daphnia pulex* collected from water of pH 7.7 to 7.9 and cultured in water of the same pH and pH 6.5 to 6.6 were measured over a wide range of pH conditions. Within 6 weeks to 2 months of exposure to the lowered pH, the population was able to feed maximally at the new pH. (Katz)
W77-09678

THE EFFECT OF WIND ON THE DISTRIBUTION OF CHLOROPHYLL A AND CRUSTACEAN PLANKTON IN A SHALLOW EUTROPHIC RESERVOIR, University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W77-09679

TEMPERATURE AS A PROXIMATE FACTOR IN ORIENTATION BEHAVIOR, Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds.
Journal of the Fisheries Board of Canada, Vol 34, p 734-739, 1977. 40 ref.

Descriptors: Fish, *Fish physiology, *Fish behavior, *Thermal pollution, *Water pollution effects, Thermal power, *Thermal stress, Thermal waters, Temperature, Trout, Salmon, Ecological distribution, Habitats, Fish reproduction, Reviews, On-site-investigations, Laboratory tests. Identifiers: *Thermoregulation(Fish), Orientation, Preferendum, Habitat selection, Avoidance, Fish responses, *Preference, *Behavioral mechanisms, Proximate and ultimate factors.

Temperature serves as a proximate factor (cue, guidepost, sign stimulus, or directive factor) affecting locomotor responses of fishes. Although temperature can also serve as an ultimate ecological factor, as in behavioral thermoregulation, nonthermal factors may in some cases provide the ultimate adaptive or ecological value of a temperature response; some examples are habitat selection, intraspecific size segregation, interspecific niche differentiation, isolating mechanisms, predator avoidance, prey location, escape reactions, and migrations (thermoperiodic, diel, seasonal, spawning). Conversely, nonthermal variables such as light intensity or water depth may act as accessory proximate factors in thermoregulation. In spawning migrations, thermal requirements of eggs and larvae may take precedence over the (often different) preference or optima of adults. Although thermal responses of fishes are largely innate and species specific, ontogenetic

and other changes can occur. Since temperature can serve as an unconditioned reinforcer in operant conditioning, thermal responses are not limited to simple kineses or taxes. Nonthermal factors such as photoperiod, circadian rhythms, currents, social and biotic interactions, stresses, infections, or chemicals can affect thermal responses, and may account for some lack of conformity between laboratory preference and field distributions and behaviors. (Katz)
W77-09680

CONTINUOUS-FLOW APPARATUS FOR USE IN PETROLEUM BIOASSAY, Battelle Pacific Northwest Labs., Sequim, Wash. Marine Research Labs.
For primary bibliographic entry see Field 5A.
W77-09681

NOTE ON THE EFFECTS OF LEAD ON OXYGEN PRODUCTION OF SEVERAL LITTORAL SEAWEEDS OF THE ADRIATIC SEA, Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
N. Zavadnik.
Botanica Marina, Vol 20, No 3, p 167-170, 1977. 2 tab, 6 ref.

Descriptors: *Toxicity, *Photosynthesis, *Lead, *Marine algae, *Primary productivity, Water pollution effects, Phaeophyta, Rhodophyta, Chlorophyta, Laboratory tests, Diurnal, Sea water. Identifiers: *Fucus, *Adriatic Sea.

Under constant conditions of salinity (37 degrees/oo) and temperature (15C) the influence of lead on oxygen production of *Fucus virsoides*, *Padina pavonia*, *Ulva rigida*, and *Laurencia obtusa* was studied. The lead concentrations in media ranged between 100-1000 ppb. In short-term tests lasting up to six days, the tidal species *F. virsoides* and *U. rigida* exhibited similar variations of net oxygen production under the slight inhibitory influence of lead. *P. pavonia* and *L. obtusa* could not adapt to experimental conditions and decayed within three days of the beginning of the experiment. Lead ion concentrations used in this experiment were below levels detectably toxic to the algal species used. (Katz)
W77-09682

INDUCTION OF HEPATIC ARYL HYDROCARBON HYDROXYLASE IN SALMON EXPOSED TO PETROLEUM DISSOLVED IN SEAWATER AND TO PETROLEUM AND POLYCHLORINATED BIPHENYLS, SEPARATE AND TOGETHER, IN FOOD, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
E. H. Gruger, Jr., M. M. Wekell, P. T. Numoto, and D. R. Craddock.
Bulletin of Environmental Contamination and Toxicology, Vol 17(5), p 512-520, 1977. 2 tab, 28 ref.

Descriptors: Fish physiology, *Chlorinated hydrocarbon pesticides, *Fish behavior, Bioassay, *Toxicity, Salmon, Juvenile fish, Laboratory tests, Animal pathology, Biochemistry, Oil, *Oil pollution, Water pollution effects, *Polychlorinated biphenyls, Enzymes, Sea water, Oil wastes, Water pollution effects.
Identifiers: *Hepatic aryl hydrocarbon hydroxylase, *Coho salmon, Soluble hydrocarbons, *Prudhoe Bay Crude Oil, Sea water soluble fractions.

Hepatic Aryl Hydrocarbon Hydroxylase (AHH) is induced in coho salmon exposed to 1 ppm PCB's in the diet; however, comparable experiments with 1 ppm of Prudhoe Bay crude oil did not significantly alter the AHH activities. These findings suggest that in aquatic food-chains containing both petroleum hydrocarbons and PCB's, the latter

compounds may exert a predominant influence on the induction of the hepatic AHH enzyme system. Despite the lack of induction of hepatic AHH with 1 ppm Prudhoe Bay crude oil in the diet, young coho salmon exposed to 150 ppb (0.15 ppm) of a seawater-soluble fraction for 6 days exhibited a significant induction of this enzyme system. Thus, crude oil components of relatively high water solubility (e.g., methylated naphthalenes and polyalkylated benzenes) may be more effective than high molecular weight insoluble components in inducing AHH. (Katz)
W77-09683

THE EFFECTS OF SALINITY, TEMPERATURE, AND MERCURY ON MORTALITY OF THE TROCHOPHORE LARVAE OF SERPULA VERMICULARIS L. (ANNELIDA: POLYCHAETA), Washington Univ., Friday Harbor. Friday Harbor Labs.
J. S. Gray.
Journal of Experimental Marine Biology and Ecology, Vol 23, p 127-134, 1976. 2 fig, 4 tab, 12 ref.

Descriptors: *Salinity, *Water temperature, *Mortality, *Mercury, *Worms, Environmental effects, *Larval growth stage, Analytical techniques, Toxicity, *Methodology, Metals, Statistical methods, Water pollution effects. Identifiers: *Serpula, Mercuric ions, Annelids, Polychaeta's response-surface contours.

Using response surface methods 4-day old larvae of *Serpula vermicularis* L. were shown to be more euryplastic with respect to salinity and temperature than were gastrulae and 1-day old larvae. Significant interaction was found between the effects of temperature and reduced salinity on mortality of the larvae at each age tested. Four-day old trochophore larvae were more resistant to reduced salinity at low temperatures than were gastrulae and 1-day old larvae. The change in tolerance with age was in resistance rather than capacity adaptation and, since the larvae were acclimated at 16C, this change was genetic. Mercuric ions did not show synergistic effects with reduced salinity but merely acted additionally. The concentrations of mercury found to be toxic were much higher than those that are likely to be found in coastal waters where *S. vermicularis* occurs. (Katz)
W77-09684

SHORT TERM VARIABILITY IN VERTICAL CHLOROPHYLL STRUCTURE, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W77-09702

DOMESTIC AND AGRICULTURAL CONTRIBUTIONS TO THE INPUTS OF PHOSPHORUS AND NITROGEN TO LOUGH NEAGH, Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5B.
W77-09722

THERMAL TOLERANCE OF TWO SPECIES OF GAMMARUS, National Water Quality Lab., Duluth, Minn.
W. E. Smith.
Trans Am Fish Soc. Vol. 102, No. 2, p 431-433, 1973.

Descriptors: *Amphipoda, Aquatic animals, Invertebrates, Crustaceans, Reproduction, Temperature, Thermal pollution, Water pollution effects. Identifiers: Acclimation, Gammarus-lacustris, Gammarus-pseudolimnaeus.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Gammarus pseudolimnaceus Bousfield acclimated at 18°C, had a 96-hr TL50 (tolerance limit) of 26°C and a 30-day TL50 of 22-24°C depending upon the test method. *G. lacustris* Sars, acclimated at 18°C, had 96-hr TL50 of 26°C and a 30-day TL50 of 25°C. Both species reproduced most successfully at 18°C; the numbers of young produced were reduced at temperatures above 18°C. Simulated winter chill was not required to stimulate reproduction in either species.—Copyright 1973, Biological Abstracts, Inc.
W77-09730

EFFLUENTS OF KRAFT MILLS AND THEIR TOXICITY FOR HYDROBIONTS (STOCHNYE VODY SUI'FAT-TSELYULOZNYKH ZAVODOV I IKH TOKSICHNOST' DLYA GIDROBIONTOV).
Biologo-Geograficheskii Nauchno-Issledovatel'skii Institut, Irkutsk (USSR).
Gidrobiologicheskii Zhurnal, Vol. 11, No. 5, p 118-125, 1975. 53 ref, 5 tab.

Descriptors: *Pulp wastes, *Toxicity, Aquatic life, *Water pollution effects, *Reviews, Effluents, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Water pollution, Phenols, Fish, Daphnia, Aquatic animals, Sulfur compounds, Effluents, Lethal limit, Evaporation, Burning, Incineration.
Identifiers: Kraft mills, *Hydrobionts.

The presence in kraft mill effluents (both crude and biologically purified) of various toxic compounds and the effect of these compounds on aquatic organisms are discussed on the basis of available literature data. Tables are presented showing the effects of various concentrations of phenols on several species of fish and on *Daphnia*; the lethal concentrations of several phenolic compounds on *Daphnia*; the toxic and lethal concentrations of sulfur compounds contained in the effluents for various fish species; the toxic and lethal concentrations for fish of other effluent components (rosin and fatty acid salts, formaldehyde, phenylmercury acetate, phytosterol, and rosin acids); and the toxic, lethal, and fish-tainting concentrations (impairing unpleasant odor and taste) of several phenolic compounds in water. It is pointed out that the only effective means to eliminate the harmful effects of kraft mill effluents is their evaporation and burning. The combustion of foul-smelling organic compounds has been recommended at the International Meeting on Industrial Effluents held in Stockholm in 1970. (Stapinski-IPC)
W77-09739

NITRATE AND PHOSPHATE CONTENT OF GROUND AND SURFACE WATERS OF THE WHITE RIVER DRAINAGE, NORTHWEST NEBRASKA.
Union Coll., Middlesboro, Ky. Environmental Education Center.
For primary bibliographic entry see Field 5B.
W77-09743

WATER TRANSPORT OF WOOD (IN CANADA): THE CURRENT SITUATION.
Environmental Protection Service, Regina (Saskatchewan). Water Pollution Control Branch. J. Karau.
Environmental Protection Service, Economic and Technical Review Report EPS 3-WP-75-3, October, 1975. 90 p, 11 fig, 77 ref, 9 tab.

Descriptors: *Water pollution, *Lumbering, Pulp and paper industry, Leachate, Bark, Costs, Water pollution effects, Wastes, Industrial wastes, Water pollution sources, Lumber, Transportation, Water quality, Wood wastes.
Identifiers: *Log rafting.

This study reviews the techniques of transporting wood (logs) by water, pointing out the pros and

cons of each method; discusses the impact of water transport on the environment (including water bodies involved, effect of leachates and bark, and modifications to river banks, channels, and stream flows to facilitate wood floatage); considers alternative means of transportation and their costs; and recommends procedures to help reduce the effects of water transport on the environment. (Witt-IPC)
W77-09755

EFFECTS OF LOG HANDLING AND STORAGE ON WATER QUALITY.
Corvallis Environmental Research Lab., Oreg. G. S. Schuytema, and R. D. Shankland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 267, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Technology Series, Report EPA-600/2-76-262, September, 1976. 84 p, 9 fig, 28 ref, 22 tab.

Descriptors: *Water pollution sources, *Lumbering, *Wood wastes, *Water quality, Lumber, Runoff, Pounding, Biological oxygen demand, Chemical oxygen demand, Color, Aesthetics, Water pollution, Wastes, Industrial wastes, Bark, Streamflow.
Identifiers: Log storage, Log ponds, Log decks, Log rafting.

The biological and chemical effects of three types of log storage on water quality were investigated. Three flow-through log ponds, two wet deck operations, and five log rafting areas were studied. Both biological and chemical aspects of stream quality can be adversely affected by flow-through log ponds and runoff from wet decks. The severity of degradation varies widely with each situation. Runoff from wet decks had pollution characteristics equal to or greater than that of the waters from the flow-through log ponds studied. Esthetically, a stream can be affected by the dark color of the water coming from a log pond or wet deck. Floating bark from a log raft or a log pond is also aesthetically displeasing. The most significant problem associated with log rafting is the loss of bark which commonly occurs when the logs are dumped into the water. (Witt-IPC)
W77-09760

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS - VOLUME I - RADFORD.
WAPORA, Inc., Washington, D.C.
B. L. Huff, W. Duckert, P. Barding, J. Wheeler, and R. B. Bogardus.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024 191, Price codes: A08 in paper copy, A01 in microfiche. Report to Army Medical Research and Development Command, Washington, D.C., December, 1975. 145 p, 16 tab, 14 fig, 75 ref, append.

Descriptors: On-site investigations, *Virginia, *Bacteria, *Protozoa, *Phytoplankton, *Periphyton, *Zooplankton, Benthos, Freshwater fish, Water quality, *Water pollution effects, *Water pollution sources, Laboratory studies, Waste water (Pollution), Water temperature, Sulfates, *Nitrites, *Nitrites, *Ammonium compounds, Aquatic populations, Aquatic animals.
Identifiers: *Munitions, *New River (Va), *Radford Army Ammunition Plant, *Macroinvertebrates, Species diversity.

Laboratory and field studies were conducted on September 16-20, 1974, at the Radford Army Ammunition Plant (RAAP) to determine possible effects of munition manufacturing wastes on the aquatic life in the New River, Virginia. Macroinvertebrate diversity was reduced below the C-line Acid Neutralization Facility and Nitroglycerin Area No. discharges and remained at a low level

on the right bank (or major effluent side of the New River), downstream, beyond the 48-inch general purpose sewer line, the A/B line discharge, and Stroubles Creek discharges. Recovery was apparent at the lower stations where the New River flows away from the RAAP boundary. Decreased macroinvertebrate community diversity was found at the stations on Stroubles Creek below the major solvent and thermal discharges as compared with an upstream reference station. Fewer species of fishes were collected at stations below the 48-inch general purpose outfall and Stroubles Creek outfall than at either upstream or downstream sampling locations. The following parameters determined from laboratory analyses of water samples were apparently affected by RAAP operations: alkalinity, color, total dissolved solids, total organic carbon, sulfates, nitrates, nitrites, and total kjeldahl nitrogen. (See also W77-09762 and W77-09763) (Katz)
W77-09761

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS, VOL. II - HOLSTON - FINAL REPORT.
WAPORA, Inc., Washington, D.C.
B. L. Huff, W. Duckert, P. Barding, J. Wheeler, and R. B. Bogardus.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024 192, Price codes: A07 in paper copy, A01 in microfiche. Report to Army Medical Research and Development Command, Washington, D.C., December, 1975. 127 p, 14 tab., 19 fig., 72 ref.

Descriptors: On-site investigations, *Tennessee, *Bacteria, *Protozoa, *Phytoplankton, *Periphyton, *Zooplankton, *Benthos, Freshwater fish, Water quality, Water pollution effects, Water pollution sources, Laboratory studies, Waste water (Pollution), Water temperature, Sulfates, Nitrates, Nitrites, *Ammonium compounds, Aquatic populations, Aquatic animals, Sediments.
Identifiers: Holston Army Ammunition Plant, *Holston River (Tenn), Munitions plants, *Macroinvertebrates, Species diversity.

Laboratory and field studies were conducted from September 23-28, and October 16, 1974 at the Holston Army Ammunition Plant (HAAP) to determine the effects of munition manufacturing wastes on the aquatic life in the Holston River, Tennessee. In addition to laboratory and field determinations of selected chemical and physical parameters the following aquatic groups were investigated: bacteria, protozoa, phytoplankton, periphyton, zooplankton, benthic macroinvertebrates and fish. Analytical data generated in this study are based on the results obtained from single grab samples and should be considered within that limitation. Of the physical/chemical in situ parameters, only pH and temperature appeared to be influenced by the plant. Water and sediment survey stations Je, Jf, K2, and M were located where discharges from HAAP Area B could conceivably affect their chemistry. Only a few parameters however, reflected the possible influence of plant activities in their concentration patterns, namely: color, dissolved sulfates, total solids (water) dissolved nitrates (water), TOC (water), and total volatile solids (sediments). (See also W77-09761) (Katz)
W77-09762

AQUATIC FIELD SURVEYS AT RADFORD, HOLSTON, VOLUNTEER, AND MILAN ARMY AMMUNITION PLANTS, VOLUME IV - MILAN, FINAL REPORT.
WAPORA, Inc., Washington, D.C.
B. L. Huff, W. Duckert, P. Barding, J. Wheeler, and R. B. Bogardus.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024 194, Price codes: A06 in paper copy, A01 in microfiche. Report to Army Medical Research and

Development Command, Washington, D.C. 20314, December 1975. 107 p, 16 tab, 15 fig, 63 ref, append.

Descriptors: On-site investigations, *Aquatic animals, *Aquatic environment, Freshwater fish, *Aquatic productivity, Zooplankton, *Water quality, *Sediments, Conductivity, Water pollution effects, *Phosphates, *Oil, *Cadmium, *Lead, *Chromium, Chemical oxygen demand, Tennessee.
Identifiers: *Monitoring, *Macroinvertebrates, Species diversity, *Milan Army Ammunition Plant, *Total dissolved solids, Total volatile solids, Orthophosphates, *Oil and grease, Obion River(Tenn).

Studies were undertaken at Milan Army Ammunition Plant (MAAP) to determine the effects of munitions wastes on aquatic life in the receiving system. The following aquatic groups were investigated: bacteria, phytoplankton, periphyton, zooplankton, protozoa, macroinvertebrates and fish. Of the physical/chemical in situ parameters, only conductivity appeared to be influenced by plant activity. Those water and sediment (laboratory) parameters which appeared to be affected as result of plant activities were: total solids (water), total dissolved solids, total volatile solids, TKN, orthophosphates, COD (water), TOC, oil and grease (water), cadmium (water), COD (sediments), lead (sediments) and chromium (sediments). Other parameters demonstrated concentration patterns not based on proximity to plant discharges. The operation of MAAP has not had an apparent significant impact on the aquatic flora and fauna of the Rutherford Fork of the Obion River. The low abundance of aquatic organisms in Rutherford Fork is primarily due to the channelized nature of the stream with its fluctuating flows, high suspended sediments load and lack of suitable habitats. These prevailing conditions make the observation of significant effluent effects and drawing of firm conclusions about the impact of MAAP impossible within the limitations of this initial survey. (See also W77-09761) (Katz) W77-09763

TOXICITY OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM), 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73), AND A 98:2 MIXTURE TO FINGERLINGS OF SEVEN FISH SPECIES AND TO EGGS AND FRY OF COHO SALMON,
Fish and Wildlife Service, La Crosse, Wis. Fish Control Lab.
T. D. Bills, and L. L. Marking.
Investigations in Fish Control No. 69, 1976. 9 p, 3 tab, 18 ref.

Descriptors: *Toxicity, *Bioassay, *Mortality, *Salmon, Fish eggs, Juvenile fish, *Pesticides, Brown trout, Rainbow trout, Lake trout, Brook trout, Channel catfish, Perches, *Hydrogen ion concentration, Laboratory tests, Sunfishes, Yellow perch, Lampreys.
Identifiers: *TFM, *3-trifluoromethyl-4-nitrophenols, 2',5-dichloro-4'-nitroso-salicylanilide(Bayer 73), *Coho salmon, *Lampricides, Safety margin, Fish control laboratory.

Toxicity was determined of the lampricides 3-trifluoromethyl-4-nitrophenol (TFM) and 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73) and a 98:2 mixture of these compounds against fingerlings of seven species of fish - brown trout (*Salmo trutta*), rainbow trout (*Salmo gairdneri*), lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), and yellow perch (*Perca flavescens*) - and to eggs and fry of coho salmon (*Oncorhynchus kisutch*). Channel catfish were the most sensitive to TFM and brown trout to Bayer 73. Bluegills were the most resistant to both TFM and Bayer 73. The toxicity of TFM and Bayer 73 individually was influenced far more by pH than was the mixture in standard

laboratory tests with rainbow trout. Toxicity of the mixture was additive or less than additive to all species and life stages tested. The mixture was slightly more toxic to larval lampreys (*Petromyzon marinus*) than to other fish in comparable laboratory toxicity tests. The margin of safety was narrow, however, when the 24-h toxicity for brown trout or rainbow trout was compared with the 24-h LC50 for sea lamprey larvae. (Katz) W77-09764

THE FRESHWATER MUSSEL (ANODONTA SP.) AS AN INDICATOR OF ENVIRONMENTAL LEVELS OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM),
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
A. W. Maki, and H. E. Johnson.
Fish and Wildlife Service, Investigations in Fish Control No. 70, 1976. 5 p, 3 tab, 9 ref.

Descriptors: *Toxicity, Bioassay, *Mortality, Laboratory tests, *Mussels, Mollusks, Biochemistry, Water pollution effects, *Physiology, *Methodology, Behavior, Monitoring.
Identifiers: *Freshwater mussels, *Anodonta, *Lampricides, 3-trifluoromethyl-4-nitrophenol(TFM), *TFM, Model stream, Uptake, Elimination rates, Radio-assay, Tissue concentrations.

After freshwater mussels (*Anodonta* sp.) were exposed to 8.68-mg/l solutions of 3-trifluoromethyl-4-nitrophenol (TFM; 14C-TFM and analytical grade TFM) in a model stream for 24 h, uptake and elimination rates of TFM residues for three body components were determined by radioassay. The average residue concentrations (micrograms TFM/g wet wt) after the 24-h exposure were 44.4 in the foot, 37.7 in the gill, and 38.5 in the viscera. The average calculated half-time for residue elimination from the three components was 20.2 h. The rate of uptake and ultimate residue concentration was widely variable, presumably because the feeding and locomotor activity of individual mussels varied greatly during the exposure period. (Katz) W77-09765

GEOCHEMICAL INTERACTIONS OF HEAVY METALS IN SOUTHEASTERN SALT MARSH ENVIRONMENTS,
Skidway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5B. W77-09767

VARIATIONS IN THE ABUNDANCE OF CHANNEL CATFISH YEAR CLASSES IN THE UPPER MISSISSIPPI RIVER AND CAUSATIVE FACTORS,
Iowa State Conservation Commission, Des Moines. Fisheries Section.
D. R. Helms.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 071, Price codes: A03 in paper copy, A01 in microfiche. Iowa Fisheries Research, Technical Series No. 75-1, December 1975. 31 p., 18 tab., 2 fig., 13 ref.

Descriptors: *Channel catfish, Freshwater fish, *Iowa, *Mississippi River, On-site investigations, Growth, *Fish populations, Fish management, Environmental effects, *Fish reproduction, Fish diseases, Parasitism, *Methodology, Water pollution effects.
Identifiers: Year classes(Catfish), Fish spawning, Mid-water trawling.

Vital statistics for channel catfish were described for Pools 9, 11, 13 and 18 in the Mississippi River to determine differences in year class abundance and causative factors. The 1970 year class was the most abundant. Very poor year classes occurred in 1971 and 1972. The 1973 year class was slightly better than 1974. Year class abundance of channel

catfish was established in the first year of life during spawning or hatching. No cause and effect relationships could be correlated with pesticides in eggs, ovarian parasites, fecundity or water level fluctuations. Spawning time and intensity was correlated to water temperature, but had no direct association to establishment of year class strength. Turbidity also influenced spawning, but was not adequately measured to determine its total effect. Factors that were suspected to be involved but not evaluated in this study, were adult population density, abundance of predator and competitor species, food availability, and the quality of spawning habitat. More than a single factor obviously affects year class abundance. Trawling in the main channel of the stream during August was determined to be the most satisfactory method of surveying year class strength of O-age channel catfish. (Katz) W77-09768

EVALUATION OF A LABORATORY MICROCOSM FOR STUDY OF TOXIC SUBSTANCES IN THE ENVIRONMENT: FINAL TECHNICAL REPORT, JULY 1, 1973-DECEMBER 31, 1975,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 5A. W77-09769

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: KETONIC SOLVENTS,
Syracuse Research Corp., N.Y. Center for Chemical Hazard Assessment.
For primary bibliographic entry see Field 5B. W77-09770

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL OF DEEP-SEA SEDIMENT BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, P. A. Seesman, T. L. Herbert, and R. R. Colwell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 884, Price codes: A02 in paper copy, A01 in microfiche. Environmental Pollution, Vol. 10, 1976. 89-99 p., 6 tab., 7 fig., 6 ref.

Descriptors: *Oil, *Oil spills, *Bacteria, Carbon compounds, *Sediments, Marine microorganisms, Marine bacteria, Phosphates, Nitrates, Nitrites, Ammonium compounds, *Decomposing organic matter, Organic compounds, Microbial degradation.
Identifiers: *Petroleum hydrocarbons, *Mixed hydrocarbon substrate, Marine sediments, *Marine sediment bacteria, Bacterial growth.

Marine sediment bacteria were found to be capable of utilizing a mixture of 19 petroleum hydrocarbons, referred to as mixed hydrocarbon substrate (MHS). Autoclaving and the addition of sediment inoculum were found to change the concentration of inorganic nutrients (PO₄, NO₃, NO₂, and NH₄) in sea water. The concentration of inorganic nutrients affected growth of sediment bacteria and their utilization of MHS. (Katz) W77-09772

TEMPERATURE EFFECTS ON YOUNG YELLOW PERCH, PERCA FLAVESCENS (MITCHELL),
Environmental Research Lab., Duluth, Minn.
J. H. McCormick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 169, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/3-76-057, May, 1976. 19 p, 1 tab, 2 fig, 31 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: Perch, *Yellow perch, Freshwater fish, *Water temperature, *Fish diseases, Environmental effects, *Thermal stress, *Thermal water, Seasonal, Methodology, Water pollution effects, *Thermal pollution.

Identifiers: Thermal variation, Seasonal variation, *Deformities(Fish).

The effect of temperature on growth of young-of-the-year yellow perch was determined over an 8-week period at constant temperatures from 8 to 34°C. Absolute growth rates peaked at 28°C, but were not significantly less ($P > 0.05$) over the range from 26 to 30°C. Deformities occurred at 32°C but at no lower temperatures, and all fish died within 7 days at 34°C. A suggested seasonal temperature cycle for yellow perch habitats is presented, based on the data from this experiment for the summer period of rapid growth and on data from previous studies for other life stages. (Kat:) W77-09773

ANALYSIS OF DATA FROM BIOLOGICAL SURVEYS OF STREAMS: DIVERSITY AND SAMPLE SIZE,
Kansas Univ., Lawrence, Dept. of Geology; and Kansas Univ., Lawrence, Museum of Invertebrate Paleontology.
For primary bibliographic entry see Field 5A.
W77-09778

LEAD AND FRESHWATER FISHES: PART 2—IONIC LEAD ACCUMULATION,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
M. Merilini, and G. Pozzi.
Environmental Pollution, Vol 13, p 119-126, 1977. 3 fig, 4 tab, 9 ref.

Descriptors: *Lead, *Absorption, Path of pollutants, *Ions, *Toxicity, *Bioassay, *Tracers, Laboratory tests, Radioisotopes, Metals, Heavy metals, *Pollutant identification.
Identifiers: *Lake Maggiore(Italy), *Bioaccumulation, *Carassius, *Italy.

When lead was added to Lake Maggiore (North Italy) water as nitrate only 8% of a 0.5 ppm lead concentration remained in the ionic state. There was good agreement between the concentration factors for radiolead and stable lead when the quantity of ionic lead was used in the calculations instead of total lead. These results and those of a previous experiment indicate that fish accumulate lead in the ionic state and that only a small amount of total lead remains in that form in freshwater with the qualities of that of Lake Maggiore. (See also W77-06435) (Katz)
W77-09779

MESENCHYMAL TUMORS OF SOME ESTUARINE FISHES IN THE NORTHERN GULF OF MEXICO. II. SUBCUTANEOUS FIBROMAS IN THE SOUTHERN FLOUNDER, PARALICHTHYS LETHOSTIGMA, AND THE SEA CATFISH, ARIUS FELIS,
Gulf Coast Research Lab., Ocean Springs, Miss. R. M. Overstreet, and R. H. Edwards.
Bulletin of Marine Science, Vol 26, No 1, p 41-48, 1976. 16 fig., 20 ref.

Descriptors: *Trematodes, *Fish parasites, *Nematodes, *Fish physiology, *Pathology, *Gulf of Mexico, *Environmental effects, Microscopy, Mississippi.
Identifiers: Tumors, *Southern flounder, *Sea catfish, Arius, *Tissue analysis, Paralicthys, *Histology, Arius.

Benign subcutaneous mesenchymal fibromas in the southern flounder and in the sea catfish collected in estuarine and marine water in Mississippi are described. Under the gular membrane of the flounder occurred two pseudocapsulated tumors, whereas only a single deeply-embedded non-en-

capsulated one occupied an area at the base of the catfish's anal fin. Because the latter tumor had a chondromatous component, it is considered to be a chondromatous component, it is considered to be a chondrosarcoma. Tumors from both fish displayed morphological similarities, including tumor cell characteristics. They contained abundant collagen, and both incorporated bony and cartilaginous spicules. The etiology of those from the flounder could be related to a philometrid nematode or a didymozoid trematode. This is the first description of tumors from Paralicthys lethostigma and Arius felis. (Katz)
W77-09780

HEAVY METAL TOLERANCE OF MARINE PHYTOPLANKTON. II. COPPER TOLERANCE OF THREE SPECIES IN DIALYSIS AND BATCH CULTURES,
Norwegian Inst. of Seaweed Research, Trondheim.
A. Jensen, B. Rystad, and S. Melson.
Journal of Experimental Marine Biology and Ecology, Vol 22, p. 249-256, 1976. 1 fig, 3 tab, 15 ref.

Descriptors: *Diatoms, *Copper, Metals, *Heavy metals, Resistance, *Growth rates, *Absorption, *Algae, *Dialysis, Phytoplankton, Laboratory tests, Chlorophyll, Photosynthesis, Primary productivity, Aquatic microorganisms, Methodology.
Identifiers: *Skeletonema, *Thalassiosira, *Phaeodactylum, Dialysis cultures, Bacter cultures.

The tolerance to copper ions of the three diatoms, *Skeletonema costatum*, *Thalassiosira pseudonana*, and *Phaeodactylum tricornutum*, grown in dialysis and batch cultures in the local fjord water was established. Reduction of growth rates was observed by the addition of 10, 25, and 400 micrograms/l of copper ions, respectively, for the three species. At higher levels of copper addition (400 and 700 micrograms/l) cells of *P. tricornutum* in dialysis culture increased their copper content to more than 200 times over those of the controls, the ratio of copper to chlorophyll in the cells increasing 150 times. All three species showed marked increases in copper content when a copper salt was added to batch cultures of the algae. The two clones of *S. costatum* tested showed nearly identical sensitivity to copper ions, but they differed in their zinc tolerance. (See also W74-11329) (Katz)
W77-09781

EFFECTS OF AROCLOR (R) 1254 ON BROOK TROUT, SALVELINUS FONTINALIS,
Environmental Research Lab., Duluth, Minn. V. M. Snarski, and F. A. Puglisi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-191 215. Price codes: A07 in paper copy, A01 in microfiche. EPA Ecological Research Series, Report EPA 600/3-76-112, December 1976. 33 p, 5 tab, 1 fig, 30 ref, append.

Descriptors: *Bioassay, Methodology, *Brook trout, Freshwater fish, *Aroclors, *Growth rates, Fish reproduction, *Polychlorinated biphenyls, *Laboratory tests, Juvenile fish, Animal pathology, Water pollution effects.
Identifiers: *Aroclor 1254, PCB Residues, *Bioaccumulation.

No adverse effects were observed on survival, growth and reproduction of brook trout exposed for 71 weeks to 0.94 ug/l, and lower concentrations of the polychlorinated biphenyl Aroclor (R) 1254 ($P=0.05$). Survival and growth to 90 days of alevin-juveniles from exposed parents were also unaffected ($P=0.05$). Polychlorinated biphenyl concentrations in the brook trout were directly proportional to the water exposure concentrations ($P=0.05$). The PCB tissue concentrations appeared to have reached a steady state by the first sampling after 14 weeks of exposure. The PCB residues

(wet-tissue basis) in chronically exposed fish were approximately 2 ug/g in the fillet and 9 ug/g in the 'whole body' (entire fish minus one fillet and the gonads) at the highest water concentration, 0.94 ug/l. The higher residue in the whole body compared to the corresponding fillet was due to the higher fat content of the former. (Katz)
W77-09783

EFFECTS OF EXPOSURE TO HEAVY METALS ON SELECTED FRESH WATER FISH. TOXICITY OF COPPER, CADMIUM, CHROMIUM AND LEAD TO EGGS AND FRY OF SEVEN FISH SPECIES,
EG and G Bionomics, Wareham, Mass. Aquatic Toxicology Lab.
S. Sauter, K. S. Buxton, K. J. Macek, and S. R. Petrocelli.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 612. Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-76-105, October 1976. 75 p, 40 tab, 49 ref.

Descriptors: *Lead, *Chromium, *Cadmium, *Copper, Brook trout, Rainbow trout, Lake trout, *Channel catfish, Suckers, Pikes, *Bioassay, *Toxicity, *Freshwater fish, Water pollution effects, *Juvenile fish, Walleye, Methodology, *Sunfishes, *Heavy metals.
Identifiers: White sucker, Northern pike.

Embryo and larvae of rainbow trout, lake trout, channel catfish, bluegill, white sucker, northern pike, and walleye were exposed for 60 days after hatch to lead and chromium in soft water. Brook trout, channel catfish, and walleyes were also exposed for 60 days after hatch to copper and cadmium in soft and hard water. The effects on survival and growth indicated that copper and cadmium were toxic at much lower concentrations than lead and chromium. Water hardness did not appear to have a significant effect on the observed toxicity in most cases. (Katz)
W77-09784

GROWTH RESPONSES OF CHICKS FED MICROBIAL PROTEIN PRODUCED FROM ORGANIC WASTES,
Tennessee State Univ., Nashville. O. L. Adams, and E. J. Thornton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 968. Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, EPA, 600/3-76-074, August 1976. 16 p., 4 tab., 1 fig., 5 ref.

Descriptors: *Organic wastes, *Organic matter, *Organoleptic properties, *Microbial degradation, *Protein, Microbiology, Foods, *Food processing industry, Fungi, Feeds, Feeding rates, *Growth rates, Growth stages.
Identifiers: Growth responses, Chicken growth response, Microbial protein, *Aspergillus, *Bacterial proteins, Growth curves, Palatability, Fungal protein, *Potato wastes.

The objective was to investigate the use of microbial protein produced from organic wastes as a source of protein in chick starting rations. Microbial protein recovered from the mold mycelia was produced when potato waste materials were homogenized and added to a mineral salt containing a culture medium suitable for the action of a strain of *Aspergillus niger*. The new product containing approximately 29.0 percent protein was added to chick starting rations, replacing the soybean protein. Sixty-two percent (62%) of the protein in the ration was supplied by soybean meal. The length of the feeding trial was four weeks. Results of the feeding trials showed that fungal protein was effective in supporting body maintenance but was ineffective in stimulating growth. Palatability of rations and poor feed con-

sumption were factors contributing to slow growth. However, feed utilization was less of a problem as shown by nitrogen retention trials. (Katz)
W77-09785

ACUTE TOXIC EFFECTS OF PETROLEUM REFINERY WASTEWATERS ON REDEAR SUNFISH,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
J. E. Matthews, and L. H. Myers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 913. Price codes: A04 in paper copy, A01 in microfiche. EPA Environmental Protection Technology Series, Report EPA 600/2-76-241, October 1976. 55 p., 4 tab., 1 fig., 14 ref., 3 append.

Descriptors: *Bioassay, *Toxicity, Freshwater fish, *Oil wastes, *Oil pollution, *Ammonia, Waste treatment, Wastewater treatment, *Phenols, *Sulfides, *Sunfishes, Industrial plants, Industrial wastes, Chemical analysis, Fish behavior.
Identifiers: Petroleum refining waste waters, *Petroleum refiners, *Redear sunfish, Lepomis, *Behavioral symptoms, Biodegradable toxicants.

Static bioassays of 24 hours' duration were performed on samples of wastewaters provided by 22 domestic petroleum refiners. These wastewaters represent three types of water discharges prevalent to this industry. Bioassays were performed using redbreast sunfish (Lepomis microlophus) as test organisms. Twenty-four hour 50 percent tolerance limits (TL50) of the various wastewaters are compared with results of chemical analyses performed during the same study. Toxicity varied considerably both between refineries and for waste streams from within a single refinery. Results of these analyses and observed behavioral symptoms of distressed fish revealed that ammonia, sulfides, and phenolics, alone or in combination, were major contributors to toxicity exerted in most samples. Three refineries had samples which were more toxic than anticipated based on results of chemical analysis, indicating the presence of other toxic compounds in unknown quantities; e.g., various hydrocarbons. (Katz)
W77-09786

THE EFFECT OF HIGH CONCENTRATIONS OF DISSOLVED OXYGEN ON SEVERAL SPECIES OF POND FISHES,
Bureau of Fisheries Lab., Fariport, Iowa.
A. H. Wiebe.
Ohio Journal of Science vol. 33, no. 2, p. 110-126, 1933. 8 tab., 7 ref.

Descriptors: Oxygen, *Supersaturation, *Bioassay, Laboratory tests, *Freshwater fish, *Fish physiology, *Fish behavior, Fish diseases, Bass, Sunfishes, Minnows, Brook trout, Rainbow trout, *Dissolved oxygen.
Identifiers: Black crappie, White crappie.

Laboratory experiments show that some species of freshwater fish tolerate large and sudden changes in the concentration of O₂ in either direction, i.e. from 5.67 ppm to 40.33 ppm and from 41.2 ppm to 7.3 ppm. Several species of fish can stand a pressure of pure oxygen of 10 to 13 lbs for a period of 24 hrs and pressures from 15 to 19 lbs for shorter periods. No instances of exophthalmus, opaqueness of the lens and the formation of gas bubbles were observed. No fish were observed to lose their equilibrium except in a few instances in the pressure experiment where depression occurred too rapidly. Exposure to high concentrations of dissolved oxygen with a superstratum of pure oxygen at atmospheric pressures and under small pressures is not harmful. (Katz)
W77-09789

INFLUENCE OF CERTAIN WATER CONDITIONS, ESPECIALLY DISSOLVED GASES, ON TROUT,
Bureau of Commercial Fisheries, Beaufort, N.C.
J. S. Gutsell.
Ecology, Vol 10, No 1, p 77-96, 1929. 7 tab, 1 fig, 53 ref.

Descriptors: *Aquiculture, Fish hatcheries, *Dissolved oxygen, Laboratory tests, Bioassay, Mortality, Water quality, Brook trout, Brown trout, Rainbow trout, *Carbon dioxide, Water supply, Hydrogen ion concentration, Fish disease, *Fish physiology, Water quality, *Trout.
Identifiers: *Asphyxiation, *Oxygen tension, Transfer experiment, Seasonal changes, Trout streams.

Change in the water chemistry with the change in seasons was investigated in the Aquicultural Laboratory of Cornell University. As the water became warmer the O₂ decreased to 1 ppm which was unsatisfactory for trout. Trout gradually accustomed to reduced O₂ survived O₂ content considerably below those fatal to trout from well oxygenated water. Asphyxiation of some trout in transfer experiments was observed in water of 2.5 ppm. At 1.3 ppm or less all asphyxiated. Recovery was observed in trout at 2.17 ppm O₂. Carbon dioxide up to 28 ppm was not harmful. CO₂ contents up to 39 ppm did not increase the ill effects of reduced O₂. (Katz)
W77-09790

HOW A HEAT PUMP IMPROVED WATER CONDITIONS AT A FISH HATCHERY,
Cornell Univ., Ithaca, N.Y. Dept. of Thermal Engineering.
F. S. Erdman.
ASHRAE Journal, Vol 3, No 2, p 62-64 and p 136, Feb 1961. 4 fig.

Descriptors: Fish disease, *Fish hatcheries, *Supersaturation, *Water supply, *Fish physiology, Environmental engineering, Atlantic Salmon, Mortalities, Dissolved oxygen, Water quality, *Water temperature, Heat transfer, *Heated water, New York, *Pumps.
Identifiers: *Heat pump, Trout hatchery, *Cooling water, *Heating water, Water coolers.

For the hatchery at Cornell University, cold water which had been saturated with atmospheric gases became super saturated when warmed. An increase of 5F in water temperature with an electric immersion heater resulted in severe gas edema in young fish. High mortality of fry occurred with popeye and some mortality of younger fish. An engineering solution to this problem utilizing a heat pump was developed. (Katz)
W77-09791

ANNOTATED EXTRACTS OF SOME PAPERS DEALING WITH THE MEASUREMENT AND SOLUBILITY OF DISSOLVED ATMOSPHERIC GASES, WITH NITROGEN GAS SUPERSATURATION, AND WITH GAS BUBBLE DISEASE IN FISH,
British Columbia Water Resources Service, Victoria.
M. J. R. Clark.
Water Resources Service, Pollution Control Branch, Revised April 1974. 212 p, 375 ref.

Descriptors: Bibliographies, *Atmospheric gases, *Dissolved oxygen, Nitrogen, *Supersaturation, Fish diseases, Fish physiology, *Fish behavior, Freshwater fish, Bioassays, Mortalities, Fishkills, Water quality, Laboratory analysis, Methodology, Gas chromatography, Solubility, Analytical techniques, On-site investigations, Reviews.
Identifiers: *Gas bubble diseases, Pop-eye, *Exophthalmia, *Nitrogen supersaturation, Annotated bibliography, Literature search.

A compilation of information and an annotated bibliography of papers regarding atmospheric gases dissolved in water and in blood are presented. These papers deal with dissolved gas supersaturation and with gas bubble disease in fish; gas supersaturation or related fish kills in Canadian waters; bio-assay investigations of gas bubble disease in fish or related gas embolism in animals; dissolved gas measurement techniques or gas solubilities and related subjects. (Katz)
W77-09792

SUPERSATURATION OF ATMOSPHERIC GASES IN THE COASTAL WATERS OF THE GULF OF MAINE,
National Marine Fisheries Service, West Boothbay Harbor, Maine. Biological Lab.
A. P. Stickney.
Fish Bulletin, Vol 67, (1), p 117-123, 1968. 1 tab, 1 fig, 13 ref.

Descriptors: Atlantic Ocean, Maine, Oceans, Water quality, *Supersaturation, *Dissolved oxygen, *Nitrogen, *Photosynthesis, Water temperature, Continental margin, Continental shelf, On-site investigations, Seasonal, Water chemistry, Fish diseases, Environmental effects, *Sea water, Seasonal.
Identifiers: *Gulf of Mexico, Year-round observations, *Oxygen supersaturation, Seasonal variations, Coastal waters, Nitrogen measurements, Causative factors, *Gas bubble diseases.

Year-round observations of dissolved oxygen in 1964-67 regularly revealed supersaturation of 120 to 150 percent during the spring and summer. Seasonal variations took the form of a sinusoidal cycle that showed definite phase relations to temperature. Comparisons with data for offshore oxygen showed that in general the coastal waters were more highly supersaturated. Nitrogen measurements made in conjunction with those of oxygen led to the conclusion that oxygen supersaturation was usually due to photosynthesis, but occasionally supersaturation of both gases indicated some physical cause. (Katz)
W77-09793

A REPORT ON STUDIES OF THE EFFECTS OF DREDGING AND DISPOSAL IN THE GREAT LAKES WITH EMPHASIS ON CANADIAN WATERS,
Canada Centre for Inland Waters, Burlington (Ontario).
P. G. Sly.
Scientific Series No 77, 1977. 38 p, 6 fig, 9 tab, 54 ref.

Descriptors: *Great Lakes, *Dredging, *Lake sediments, Wastes, *Waste treatment, *Waste disposal, Chemical wastes, Heavy metals, Water temperature, Water sampling, Pore water, Sedimentation rates, Water quality, Mud, Clays, *Canada.
Identifiers: *Open lake disposal, Confined disposal, Great Lakes Water Quality Agreement(Canada-US).

Following establishment of the Great Lakes Water Quality Agreement in 1972, open-lake disposal activities have been much reduced. Since 1972, a number of unpublished studies have been undertaken to assess the influence of dredging practices on water quality and this report refers principally to studies in the Canadian portion of the Great Lakes which, in most cases, have been undertaken in conjunction with regular dredging operations. At Port Stanley (Lake Erie) and Bronte Harbour (Lake Ontario), in studies before, during and after maintenance dredging, it was shown that total and reactive phosphorus levels increased rapidly in the receiving waters both at the removal site and at the open-lake dumping site; similar increases in other nutrient elements and heavy metals were also observed. As a result of particle settling and dilution, elevated concentra-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

tions decreased rapidly and background conditions in the overlying waters were generally re-established within a few hours. Because of the influence of wave activity in Lake Erie the dumped materials were rapidly redistributed and no evidence was obtained to indicate a long term influence on water chemistry. At Thunder Bay (Lake Superior) recent evidence suggests that some harbour materials disposed of in deep water, below wave base, may continue to influence overlying waters for extended periods. At Mitchell Bay (Lake St. Clair), containment of dredged materials in an artificial island was examined, particularly to assess the significance of sediment water exchange processes. Tests were made both upon pumped slurry and on dumped materials after settlement. Despite seasonal variations in surface materials pore water concentrations below about 1.5 m remained sensibly constant; concentrations of Al, Cd, Cu, Pb and Zn were similar and concentration profiles of Fe, Mn and P showed strong dependence upon pH and redox potential; Hg in pore water remained independent of sediment values. (WATDOC) W77-09794

IMPACT ON MARINE BENTHOS OF WASTE WATER DISCHARGE, California Univ., Davis. Dept. of Civil Engineering. G. T. Orlob, and D. A. O'Leary. Journal of the Environmental Engineering Division-ASCE, Vol. 103, No. EE2, p 307-320, April, 1977. 8 fig, 1 tab, 8 ref.

Descriptors: *Outfalls, *Pollution abatement, *Benthos, Water pollution sources, Biochemical oxygen demand, Monitoring, Sediments, Treatment facilities, Aquatic animals, Performance, Evaluation, Mollusks, Crustaceans. Identifiers: San Diego Bay(CA), Enchinoderms, Polychaetes.

Results were presented from recent investigations on the effects of waste water discharge from Point Loma into San Diego Bay. This plant began operation in 1963 and has been successful in restoring the Bay as a community asset. This review emphasized the response of marine benthos, including benthic animal populations, to changes occurring during the life of the outfall. At the time of this study, 1974, mean daily discharge was slightly less than 40% above hydraulic design capacity. Wastes treated were primarily domestic, with contributing industrial and commercial wastes. Most discharge regulations, except suspended solids removal, are being met even with this low efficiency operation. High BOD content in sediments on the ocean floor have not produced detrimental effects in marine organisms. The distinctive BOD pattern around the outfall has shrunk in recent years, creating an equilibrium with organic sediments from the outfall. The changes in benthic populations due to the changing organic content of the sediments appeared to be a response to the change in nutrient supply. Polychaetes and mollusks were stimulated by the outfall. Enchinoderms and crustaceans were less adaptable to the outfall environment, but were still prominent. The extreme resilience of the Bay environment, demonstrated by the recovery from high loadings of the 1960s, indicates that present load levels can be accepted without environmental deterioration. Increasing the plant's treatment efficiency was thought to be the key to increasing total flow treated and delivered to the Bay beyond present levels. (Collins-FIRL) W77-09846

WASTEWATER MICROBIOLOGY, Texas A and M Univ., College Station. Dept. of Biology. For primary bibliographic entry see Field 5D. W77-09893

FILTERING RATE INHIBITION OF DAPHNIA PULEX IN WINTERGREEN LAKE WATER, Michigan State Univ., East Lansing. Dept. of Zoology. P. H. Crowley. Limnol Oceanogr. Vol. 18, No. 3, p 394-402, 1973.

Descriptors: *Anabaena, *Daphnia, Filtration, Inhibition, Plankton, Seston. Identifiers: Anacystis, Daphnia-pulex, Rhodotulula-sp, Wintergreen Lake(Michigan).

The difference between the effects of seston concentration and dissolved substances on the rates of filtering and feeding by *D. pulex* in the water of a small eutrophic lake (Michigan) was studied during late summer (16-18 Aug. 1971). Low concentrations of ³²P-labeled yeast, *Rhodotulula* sp., were added to whole lake water, lake water filtrate, and seston resuspended in filtered tapwater to measure grazing by field-collected animals. Lake water seston limited grazing rates at ambient concentration; 'dissolved' inhibitors capable of limiting filtering rates at lower seston concentrations were also present, but their effects were masked by high seston concentration. Possibly these dissolved substances were excreted into solution by the dense phytoplankton population, notably including *Anabaena* and *Anacystis*. Mathematical expressions for filtering and feeding rates as functions of seston concentration are derived from Holling's disc equation and fit to the data.—Copyright 1974, Biological Abstracts, Inc. W77-09910

PRODUCTIVITY OF CLARIAS BATRACHUS IN THE SEWAGE FERTILIZED FISH PONDS, National Environmental Engineering Research Inst., Nagpur (India). K. P. Krishnamoorthi, M. K. Abdulappa, and A. V. J. Rap. Indian Journal of Environmental Health, Vol 18, No 4, p 292-298, October, 1976. 6 fig, 5 ref.

Descriptors: *Fish management, *Catfishes, *Sewage effluents, Fishkill, Algae, Oxidation lagoons, Fish stocking, Fish populations, Fish farming, Carp, Fertilization.

Two fish ponds, fertilized with stabilization pond effluent, were stocked with *Clarias batrachus* to reduce fishkill from seasonal algal blooming. A study was conducted to determine *C. batrachus* growth, as well as related chemical and biological parameters. Over a two-year period the fish ponds were 20-30 C, and pH ranged from 7 to 9.5. Observed pH fluctuations resulted from high photosynthetic activity and community respiration. *C. batrachus* were able to survive extreme environmental conditions and ammonia toxicity created at high pH values. The BOD, nitrogen, and phosphate ratio was 60:30:4 indicating excessive nitrogen and adequate phosphate concentrations to support a blooming proportion of algae. Indian catfish culture is quite young and there is no regular source of supply. It was concluded that large-scale catfish culture in ponds and swamps receiving sullage, sewage and treatment plant effluent could enhance the production of catfish as a food source. (Collins-FIRL) W77-09922

CHARACTERISTICS OF THE ZOOPLANKTON OF THE LOWER REACHES OF THE IRGIZ AND TURGAY RIVERS, (IN RUSSIAN), Kazakh Research Inst. of Fisheries, Bakhsh (USSR). T. A. Petrova. Gidrobiol Zh 12(3), p 67-69, 1976.

Descriptors: *Mesotrophy, Eutrophication, Lakes, *Zooplankton, Food chains, Crustaceans, Copepods, Fish management. Identifiers: Brachionus, Filinia, Irgiz, Keratella, *Rotifers, *USSR(Kazakh SSR).

In an effort to facilitate the rational use of fish resources and increase fish productivity, the zooplankton populations in 13 lakes in the lower reaches of the Irgiz and Turgay Rivers (Kazakh SSR, USSR) were studied. The greatest species variety was manifested by the rotifers, with *Keratella*, *Brachionus* and *Filinia* dominating in numbers. In general, the lakes were characterized by a rotifer-copepod zooplankton fauna in the spring and a cladoceran-copepod fauna in the fall. With the exception of Lake Baytakkol, which had eutrophic features, the lakes studied could be preliminarily designated mesotrophic.—Copyright 1977, Biological Abstracts, Inc. W77-09940

PLANKTONIC CILIATES IN THE IVAN'KOVO WATER RESERVOIR, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod. N. V. Mamaeva. Zool Zh 55(5), p 657-664, 1976.

Descriptors: *Protozoa, Reservoirs, *Plankton, *Heated water, *Thermal pollution, Water pollution effects, Mortality. Identifiers: Codonella-cratera, Infusoria, Strombidium-velox, Strombidium-velox, Tinninidum-fluviatile, *USSR(Ivan'kovsky Reservoir).

Studies of planktonic ciliates were carried out in the Ivan'kovsky Water Reservoir (Russian SFSR, USSR) from April-Sept. 1972-1973. Of 80 spp. of Protozoa determined, 77 being to Infusoria. The faunal composition changed markedly by seasons. Some species (*Tinninidum fluviale*, *Codonella* cratera, *Strombidium viride*, *Strombidium velox*) occurred constantly in large numbers. The maximum ciliate development fell on the 1st half of May when the greatest number of species and the high population density were registered. Observations in the heated water zone of the Konakovskiy Electric Power Station show that the heat exerted a marked effect on the development of ciliates. The population density of ciliates in the heated zone is much higher both in spring and autumn. The summer species appear in spring earlier than outside the limits of this zone and survive much longer in autumn. The death of ciliates was noted in the water running through the equipment of the electric station. The saprobity of the reservoir was determined by the composition and population density of ciliates; it approaches the level of beta-mesosaprobic water bodies.—Copyright 1977, Biological Abstracts, Inc. W77-10010

POTENTIAL ENVIRONMENTAL CONSEQUENCES OF TERTIARY OIL RECOVERY, Energy Resources Co., Inc., Cambridge, Mass. C. Braxton, R. Stephens, C. Muller, J. White, and J. Post. Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 646. Price codes: A11 in paper copy, A01 in microfiche. Final Report to Environmental Protection Agency, Washington, D.C., Office of Planning and Evaluation, July 1976. 229 p, 41 fig, 46 tab, 2 append. 68-01-1912.

Descriptors: *Resources development, *Baseline studies, *Water quality control, *Oil industry, *Environmental effects, Oil pollution, Hazards. Identifiers: *Oil recovery, Enhanced recovery, Environmental impact.

Potential environmental problems associated with the so-called tertiary or enhanced oil recovery methods (micellar-polymer flooding, polymer flooding, surfactant flooding, hydrocarbon miscible displacement, carbon dioxide miscible displacement, steam displacement (or drive), cyclic steam stimulation, and in-situ combustion (or fire-flooding) are identified. Possible impacts on ambient air quality, groundwater supplies and water quality are assessed qualitatively, and where

possible quantitatively, using dispersion modeling and risk estimates. The report examines those potential problems which are unique to enhanced oil recovery as well as post-operational problems such as chemical degradation products. Forecasts of enhanced oil recovery activity are allocated by process and region for use in impact analysis. Research needs are described to evaluate the problem areas. (Sinha-OEIS)
W77-10023

IDENTIFICATION AND ANALYSIS OF MID-ATLANTIC ONSHORE OCS IMPACTS.

Resource Planning Associates, Cambridge, Mass. Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 925. Price codes: A13 in paper copy, A01 in microfiche. Federal Energy Administration, Office of Energy Resources Development, Report No. FEA/G-76-279, February 1976. 283 p, 7 append, 13 exhibits. Prepared for the Middle Atlantic Governors' Coastal Resources Council.

Descriptors: *Continental shelf, *Resources development, *Baseline studies, *Water quality control, *Leases, Land use, Oil industry, Oil pollution, Environmental effects.
Identifiers: *Outer Continental Shelf, Coastal zone, *Mid-Atlantic bight, *Environmental impact.

Because of uncertainty concerning the proposed lease sales, the manner in which the DOI and other federal agencies would implement existing OCS legislation, and the possibility of new OCS legislation being passed prior to the sales, the Middle Atlantic Governors' Coastal Resources Council (MAGCRC) felt that it was essential to identify the nature and magnitude of onshore socioeconomic and environmental impacts, the management decisions and associated informational needs that would be required under existing legislation and regulations if the MAGCRC states were to play a significant role in OCS energy resource planning and coastal zone development, and the possible effects on the states of the policy options contained in proposed legislation. Therefore, this report analyzes and evaluates critically the recent literature on onshore socioeconomic and environmental impacts to indicate required management decisions and policy choices for the next decade, and recommends additional study needs. (Sinha-OEIS)
W77-10027

STUDIES ON THE BOTTOM FAUNA OF FOUR LAKES IN EASTERN HIKKAIDO (LAKES KUSHYARO-KO, AKAN-KO, TORO-KO AND SHIKARIBETSU KO, (IN JAPANESE), Mienken Science Education Center, Yokkaichi (Japan).

N. Kitagawa.
Jpn J Limnol 37(1), p 37-41, 1976.

Descriptors: Lakes, *Benthic fauna, *Dissolved oxygen, Hydrogen ion concentration, *Diptera, Aquatic animals.
Identifiers: Chaoborus-sp, Chironomus plumosus, Kusshyaro-ko, Procladius-sp, Sergentia-sp, Shikaribetsu-ko, Spaniotoma-sp, Toro-ko, Tubifex-sp, *Japan(Eastern Hikkaido).

Lakes Kusshyaro-ko, Akan-ko, Toro-ko and Shikaribetsu-ko (Japan) were investigated in 1973 regarding their bottom fauna. In lake Kusshyaro-ko, only Spaniotoma sp. was found in the profundal zone. The dissolved O₂ was rich and the pH value was 4.2 through the layers from the surface to the bottom at the central part of the lake. In Lake Akan-ko, expecting the azoic zone deeper than 32 m, Chironomus plumosus, Sergentia sp. and Procladius sp. occurred widely; C. plumosus was dominant. In Lake Toro-ko Chaoborus sp. and C. plumosus are distributed widely almost all over the bottom. The former made up 59.5% and the latter 33.4% of the total bottom fauna. In Lake Shikaribetsu-ko macroscopic animals were scarce

in the zone deeper than 95 m, where the dissolved O₂ contents were 0.33 cm³/l. Tubifex sp. occurred abundantly on the bottom shallower than 75 m, but chironomid larvae were very scanty.—Copyright 1977, Biological Abstracts, Inc.
W77-10028

REPORT ON A BIOLOGIC AND SEDIMENTOLOGIC STUDY RELATED TO THE TYBEE ISLAND BEACH NOURISHMENT PROJECT AND THE OFFSHORE AREA FOR DREDGE MATERIAL DISPOSAL.

Skidaway Inst. of Oceanography, Savannah, Ga. For primary bibliographic entry see Field 2L.
W77-10029

THE EFFECT OF COPPER ON COMPETITION BETWEEN MARINE ALGAE.

Manchester Polytechnic (England). Dept. of Chemistry and Biology.
A. H. Fielding, and G. Russell.
Journal of Applied Ecology, Vol. 13, No. 3, p 871-876, 1976. 2 fig, 1 tab, 14 ref.

Descriptors: *Copper, *Marine algae, *Competition, *Plant growth, *Laboratory tests, Evaluation, Graphical methods, Testing, procedures, Cultures.
Identifiers: Ectocarpus siliculosus, Erythrotrichia carnea, Ulothrix flacca.

Difficulties previously demonstrated in studying interspecific competition in laboratory algal cultures by the de Wit 'replacement series' method, where the length of the lag phase is related to the amount of inoculum supplied, were overcome by growing three marine algae species together in matched pairs. This 'triangular' method was applied to a copper non-resistant strain of Ectocarpus siliculosus, Erythrotrichia carnea and Ulothrix flacca with copper chloride additions ranging from 0 to 500 microgram/cu decimeter. The growth of all species decreased in the higher copper concentrations but interaction between pairs of species varied with the amount of copper concentration. Ectocarpus was strongly competitive against Ulothrix in all but the most concentrated copper solutions and apparently benefits from the presence of Ulothrix in small quantities. Ulothrix performs better against Erythrotrichia in the control and most dilute copper solutions; at higher copper concentrations erythrotrichia evidently benefited from the presence of Ulothrix. In the lower copper concentrations, Erythrotrichia was the dominant member of the pair when grown with Ectocarpus. This situation was reversed at the higher copper concentrations when Ectocarpus was the more successful. The data is presented as standard de Wit replacement series (log yield/density plots) and in a tabular form devised by the authors. The de Wit diagrams work better for data analysis. (Auen-Wisconsin)
W77-10051

ALGAL NUTRIENT AVAILABILITY AND LIMITATION IN LAKE ONTARIO DURING IFGYL PART 1, AVAILABLE PHOSPHORUS IN URBAN RUNOFF AND LAKE ONTARIO TRIBUTARY WATERS.

Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
W. F. Cowen, and G. F. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 974. Price codes: A11 in paper copy, A01 in microfiche. EPA-600/3-76-094a, October 1976. 230 p, 23 fig, 64 tab, 94 ref. 1BA608, EPA R-8000537-02.

Descriptors: *Lake Ontario, *Phosphorus, Cycling nutrients, Limiting factors, Runoff, Precipitation (Atmospheric), Algae, Urban runoff, Lakes, Nutrients.
Identifiers: *Nutrient availability, Particulate phosphorus, Phosphorus availability.

Research investigating the availability of phosphorus forms in urban runoff at Madison, Wisconsin was applied to the study of P availability in tributary waters of Lake Ontario. Total P, soluble P, particulate P and soluble reactive forms were measured in runoff, precipitation and riverine samples from Madison and from rivers in New York state; determinations were also made for acid-extractable, base-extractable and anion exchange resin inorganic P from the particulate fractions. Algal assays assessed portions of the P fractions available for Selenastrum capricornutum growth. Availability of particulate P from the runoff ranged from 8-55% at Madison, from 1-24% in the Genesee, Oswego and Black rivers. Precipitation samples showed less than 9% phosphorus availability. About 39, 24 and 15% of particulate P in urban runoff from Madison could be extracted by acid, base and anion exchange respectively. Results from urban areas in the Genesee River Basin in New York were similar. Resin extractions in long-term aerobic dark incubations produced results similar to short-term tests, indicating that physical and chemical processes rather than microbial mineralization processes were probably the key factors regulating release of inorganic P. (Harris-Wisconsin)
W77-10052

AN INVESTIGATION OF THE NEARSHORE REGION OF LAKE ONTARIO IFGYL.

State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 268. Price codes: A13 in paper copy, A01 in microfiche. Report No. EPA-600/3-76-115, December 1976. 282 p, 67 fig, 56 tab, 110 ref, 2 append. 1BA608, EPA 800701.

Descriptors: *Lake Ontario, *Baseline studies, *Cladophora, *Water quality, Zooplankton, Dissolved oxygen, Thermal stratification, Shores, Biomass, Benthos, Nutrients, Phytoplankton, Canada, New York, Great Lakes.
Identifiers: Genesee River(NY), Niagara River(NY), Welland Canal(Canada).

Biological, physical and chemical baseline data were gathered in the nearshore region of Lake Ontario from the Welland Canal to the area of Rochester, New York, between April 1972 and May 1973. The worst water quality conditions were seen at the Genesee and Niagara River mouths. A thermal bar, however, kept the most nutrient-enriched waters near the shoreward side. Wave action and a lack of suitable substrate for attachment, rather than chemical factors, were the key factors limiting Cladophora growth. The physical nature of the sediment was important in determining the type of benthos found in each part of the study area. Twelve previously unreported zooplankton species and one such phytoplankton species were collected in the lake during the study. Higher concentrations of nutrients, volatile solids and heavy metals were noted in sediments with higher clay contents. Measurements made during the study included: dissolved oxygen; light; temperature; phytoplankton; biomass; zooplankton; benthos; cladophora; sediment nutrients, toxicants, and quality indicators; and water chemical nutrients, toxicants and quality indicators. (Harris-Wisconsin)
W77-10053

RESTORATION OF LOWER ST. REGIS LAKE (FRANKLIN COUNTY, NEW YORK).

New York State Dept. of Health, Albany. Environmental Health Center.
G. W. Fuhs, S. P. Allen, L. J. Hetling, and T. J. Tofflemire.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 278. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-77-021, February 1977. 118 p, 39 fig, 24 tab, 50 ref. 1BA031, EPA R-801529.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Eutrophication, *Algal control, *Phosphates, Cyanophyta, Aquatic weed control, Diatoms, Sewage treatment, Nutrient removal, Chemical precipitation, Iron, Lakes, *New York. Identifiers: *Lake restoration, *Lower St. Regis Lake(NY), *Ferric chloride, *Phosphate removal, Sewage diversion.

Successful efforts to restore Lower St. Regis Lake in the Adirondack region of upstate New York by point-source phosphorus input control are described. Severe eutrophication had become evident by the presence of summer-long cyanophyta blooms caused by local phosphate discharges. Ferric chloride rather than alum was selected as a precipitant for phosphate to avoid possible stimulation of microbial sulfate reduction in the lake by sulfate additions. The ferric chloride was added and ferric phosphate sludge was removed from the lake basin during three periods from 1972-1974, and a year-around diversion project of the effluent to a sand bed 250 meters from the lake was initiated in mid-1974. Evidence of the recovery of the lake was seen in 1975, when the usual spring bloom of flagellates and diatoms did not occur. Additional evidence was seen in that the summer bloom was delayed in 1974 and was further reduced in duration and intensity the following summer. It is thought that the high iron content of the lake might be speeding its recovery. However, continued hypolimnetic oxygen depletion thought to be caused by methane formed in the sediments is seen as a delaying factor in the restoration. (Harris-Wisconsin)
W77-10054

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION: VOL. 4. PHYTOPLANKTON OF LAKE MICHIGAN.

National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
S. J. Tarapchak, and E. F. Stoermer.
Prepared for ERDA by Argonne National Laboratory, Argonne, Illinois, Report No. ANL/ES-40, Vol. 4, December 1976. 211 p, 89 fig, 37 tab, 249 ref. ERDA W-31-109-Eng-38.

Descriptors: *Lake Michigan, *Phytoplankton, *Eutrophication, Systematics, Primary productivity, Trophic level, Diatoms, Cyanophyta, Phosphorus, Spatial distribution, Temporal distribution, Speciation, Silica, Nitrogen fixation, Data collections, History, Varieties, Biological communities, Great Lakes.

A report summarizes published information on phytoplankton research in Lake Michigan, ranging from algal taxa and variations in phytoplankton standing crop and composition to primary productivity, limiting nutrient interactions, and trophic state evaluations of the lake. A line of evidence is presented—based on dominance shifts away from diatoms and in favor of chlorophyta abundance near Milwaukee and Chicago and toward the growth of chlorophyta and cyanophyta offshore in the southern basin—to suggest that the lake is undergoing serious cultural eutrophication because of phosphorus loading increases. Six major topics are covered in the report: (1) a historical synopsis of phytoplankton research and literature review; (2) spatial and temporal variations in phytoplankton abundance and species composition; (3) spatial and temporal variations of primary productivity; (4) an examination of the phosphorus-silica-eutrophication hypothesis in relation to nutrient concentrations and loading rates of nutrients; (5) dynamics of phytoplankton succession in Green Bay and the ecological significance of nitrogen fixation by plankton; (6) a general account of the sampling problems and limitations and advantages of various quantitative methods for use in planktonic lake studies. (See also W77-03566 and W74-09407) (Harris-Wisconsin)
W77-10056

BIOLOGICAL, CHEMICAL AND PHYSICAL RELATIONSHIPS IN THE STRAITS OF MACKINAC.

Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. L. Schelske, E. F. Stoermer, J. E. Gannon, and M. S. Simmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 993, Price codes: A13 in paper copy, A01 in microfiche. Report No. EPA-600/3-76-095, October 1976. 283 p, 112 fig, 42 tab, 88 ref. 1BA608, EPA R 802721.

Descriptors: *Straits, *Great Lakes, *Flow, *Water quality, Lake Michigan, Lake Huron, Lake Superior, Subsurface flow, Statistical methods, Cyanophyta, Phytoplankton, Zooplankton, Crustaceans, Hydrology, Currents(Water). Identifiers: *Straits of Mackinac(Lake Michigan-Lake Huron).

Investigations of inter-lake surface and subsurface water transfers in the straits of Mackinac area showed that movement of water eastward from Lake Michigan had a subtle deleterious effect on water quality in Lake Huron. Environmental conditions in the straits were influenced by: (1) net transport of water from Lake Michigan to Lake Huron; (2) an oscillatory flow of water produced by seiches between the two lakes; and (3) hypolimnetic transport of water from Lake Huron to Lake Michigan during periods of thermal stratification. Using data gathered during cruises in August-October 1973, four separate techniques were used to delineate water masses in the straits resulting from mixing of the waters of Lakes Michigan, Huron and Superior: (1) Multivariate statistical techniques showed that water masses could be identified with cluster analysis; (2) ordination analyses of plankton assemblages closely related data stations; (3) temperature-conductivity plots were useful in identifying surface water masses; (4) various analyses were made for single parameters, including values for silica, specific conductance, pH, nitrate and temperature. Phosphorus is transported into Lake Huron from Lake Michigan, but the latter waters are relatively depleted of silica and nitrate. During late summer these transported waters are dominated by cyanophyta distinct from those found in the open waters of either lake. Cladocerans were more prevalent in Lake Michigan than were calanoid cladocerans in Lake Huron. (Harris-Wisconsin)
W77-10058

UNDERWATER HABITATS FOR SCIENTIFIC RESEARCH IN THE GREAT LAKES.

Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
For prima. bibliographic entry see Field 7B.
W77-10060

LIMNOLOGICAL INVESTIGATION OF THE MUSKEGON COUNTY, MICHIGAN, WASTE-WATER STORAGE LAGOONS. PHASE I.

Western Michigan Univ., Kalamazoo. Dept. of Biology.
W. R. Frykberg, C. J. Goodnight, and P. G. Meier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 631, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-75-009, September 1975. 98 p, 23 fig., 16 tab., 42 ref.

Descriptors: Waste water treatment, Impaired water use, *Oxidation lagoons, *Sewage lagoons, Water quality, Biological properties, *Eutrophication, Sewage treatment, Seepage, Zooplankton, Cyanophyta, Chlorophyta, Diptera, Phytoplankton, Protozoa, Oligochaetes, *Limnology, Irrigation, *Michigan. Identifiers: *Muskegon(Mich).

Special emphasis was given to biological aspects of the water quality and to the benthic and planktonic populations, in an investigation of the lim-

nological effects of two 850-acre wastewater storage lagoons which form part of the Muskegon (Mich.) Wastewater Land Irrigation System. Turbidity, BOD, total organic carbon, nutrients, anions and metals (except for magnesium) were all higher in the East Lagoon than in the West Lagoon, and the former was also slightly less alkaline. Waters in the East Lagoon consisted primarily of semi-treated municipal and industrial wastewater, while those of the West Lagoon were usually only seepage and ground water. Chironomids accounted for 97% of the scant benthic fauna. The limited presence of the oligochaete *Limnodrilus* indicates the lagoons will support benthic organisms and that a more dense and diverse benthic community will develop later. The number of zoo-plankton per liter was consistently higher in the enriched East Lagoon. Green algae clearly dominated the phytoplankton and protozoan populations, with 55.4% in the East Lagoon and 67.4% in the West Lagoon. The proportion of this chlorophyta steadily increased with distance from the source of the wastewater discharge in the East Lagoon. Cyanophyta represented 25.3% of the phytoplankton and protozoan population in the West Lagoon. (Harris-Wisconsin)
W77-10061

TACONITE TAILINGS DISPOSAL, RESERVE MINING COMPANY, SILVER BAY, MINNESOTA.

Weston (Roy F.), Inc., West Chester, Pa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 346, Price codes: A09 in paper copy, A01 in microfiche. Report October 1971. 169 p, 26 fig., 49 tab., 5 ref.

Descriptors: *Mine wastes, *Waste dumps, *Lake Superior, *Environmental effects, *Comparative costs, Installation costs, Maintenance costs, Operating costs, Treatment facilities, *Minnesota, Waste water(Pollution), Waste water disposal, Waste water treatment, *Evaluation, Great Lakes. Identifiers: *Taconite tailings, Reserve Mining Co.(Minn), *Silver Bay(Minn).

Findings are presented from an independent evaluation of feasible wastewater treatment and disposal alternatives that might be used by the Reserve Mining Co., Silver Bay, Minnesota, whose processing plant for taconite ore deposits approximately 67,000 tons of taconite tailings into Lake Superior along its northern shore. It was previously found that the waste discharge without treatment had deleterious effects on the water quality of the lake. The present report includes: (1) a collection and review of all available pertinent information from prior studies and conferences in regard to the Reserve Mining Co. dispute; (2) a comparison of all previously proposed treatment and disposal schemes on the basis of economics and environmental impact; (3) an analysis of Reserve Mining and similar operations to determine the impact of various ore beneficiation processes on wastewater characteristics, quantities and variability; (4) a determination of optimum treatment parameters, including flocculant dosages, settling velocities and solids thickening and dewatering characteristics, on individual process streams and/or combined effluents; (5) development of conceptual treatment processes or methods for handling taconite wastes as based on parameters established in the previous steps; (6) evaluation of the long-range impact of tailings disposal on the environment; (7) review and analysis of economic and financial considerations relative to taconite processing and to the overall waste treatment objectives. (Harris-Wisconsin)
W77-10062

BIOLOGICAL EFFECTS AND PERSISTENCE OF METHYL PARATHION IN CLEAR LAKE, CALIFORNIA.

Lake County Mosquito Abatement District, Lakeport, Calif.
C. S. Apperson, R. Elston, and W. Castle.

Environmental Entomology, Vol. 5, No. 6, p. 1116-1120, 1976. 3 fig., 1 tab., 9 ref.

Descriptors: *Pesticide residues, *Zooplankton, *Fish, Persistence, Insecticides, Sunfishes, Daphnia, Copepods, Lake sediments, Crustaceans, *California, Lakes.
Identifiers: *Methyl parathion, *Clear Lake(Calif), Diatomus franciscanus, Cyclops, Mesocyclops, Daphnia, Bosmina longirostris, Diaphanosoma brachyurum, Ceriodaphnia reticulata.

Methyl Parathion was applied to Clear Lake, California, in dosages of 3.3 ppb to control effects of the non-biting Clear Lake gnat (Chaoborus astictopus) on zooplankton and fish, but little positive effect was achieved. Three treatments at 20-day intervals had no lasting impact on zooplankton; recovery was rapid for the examined organisms, including copepod nauplii, Diatomus franciscanus, Cyclops, Mesocyclops, Daphnia, Bosmina longirostris, Diaphanosoma brachyurum, and Ceriodaphnia reticulata. The first two treatments had no effect on the abundance of Cyclops and Mesocyclops. Diatomus declined by 32% following the second treatment. A concomitant decrease in the average length of diatomus suggested that mortalities among the larger organisms had occurred. Nauplii populations declined, then again after the last treatment, but Diaphanosoma continued to decline to a level reaching 55% of pretreatment. No methyl parathion residues were found in the sediment samples, suggesting that it is rapidly degraded. Highest residues were found in the bluegill sunfish (Lepomis macrochirus) and varied from 11 to 110 ppb which corresponded to a 39-28-fold increase in methyl parathion relative to the concentration residues in waste. Levels accumulated by the bluegills were expected to diminish as the concentration of methyl parathion in water declines following the final treatment. (Auen-Wisconsin)
W77-10063

DETERMINING PHOTOSYNTHETIC PRODUCTIVITY IN STREAMS,
Massachusetts Water Resources Commission, Westborough. Water Quality Section.
J. B. Erdman.
The Certificated Engineer, Vol 49, No 6, p 114-117, 1976. 4 fig, 3 ref.

Descriptors: Dissolved oxygen, Costs, Water quality standards, *Photosynthesis, Computers, Streams, *Massachusetts, *Productivity, Forecasting.

The question faced by the Water Quality Section of the Massachusetts Division of Water Pollution Control is: In what cost-effective manner can the Massachusetts Water Quality Standards be insured against violation. In the course of answering this question, vast amounts of data, both on the waterways and on the existing pollution discharges are obtained and analyzed. To make predictions, it is necessary to know the present state of affairs. Dissolved oxygen content is one important factor used in these predictions. The purpose of performing a dissolved oxygen analysis for a stream is to insure that the dissolved oxygen concentration in all parts of the stream will always remain above a certain level, prescribed by the Standards. The magnitude of all natural and man-induced factors, which at present significantly affect the dissolved oxygen concentration in the stream are determined. One such factor is photosynthetic productivity. A method is described for determining the productivity utilizing dissolved oxygen data from the stream. (So African Water Info Center)
W77-10080

THE CASE FOR THE EXPANDED STUDY OF FRESHWATER POLLUTION ZOOLOGY,
Zululand Univ., Empangeni (South Africa). Dept. of Botany.
P. E. Reavell.

South African Journal of Science, Vol. 72, No. 9, p. 260-261, September 1976. 7 refs.

Descriptors: *Hydrobiology, *Freshwater, *Water pollution, *Aquatic animals, Aquatic weeds, *Research priorities, Invertebrates, Benthos, Environmental effects, *Bioindicators, Laboratory tests, On-site tests, Reservoirs, Rivers, Lakes, *Sampling, *Monitoring, *Ecosystems, Africa.
Identifiers: *South Africa.

A research program is suggested, including the following projects:- Annual sampling programs in various ecosystems, including the monitoring of the water, sediments and living material. Dominant species in terms of both biomass and standing crop must be established. Stress responses of test organisms to different combinations of pollutants, at all stages of the life cycle, must be determined experimentally. The effect of intermittent pollution must be determined. Effects of pollution on biological productivity must be studied. A serious study of the interrelations of pollution and the freshwater ecosystem is envisaged. (So African Water Info Center)
W77-10086

DEHYDRATION OF MARINE ZOOLOGICAL MATERIAL - VOLATILITY OF METABOLISED SELENIUM AT 105-120C,
Department of Industries, Cape Town (South Africa). Div. of Sea Fisheries.
For primary bibliographic entry see Field 5A.
W77-10095

LAKE SIBAYA - A LAND-LOCKED ESTUARY,
Rhodes Univ., Grahamstown (South Africa) Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-10099

5D. Waste Treatment Processes

SOME EFFECTS OF LIME ADDITION ON HIGH SOLIDS, COMPLETELY MIXED, ACTIVATED SLUDGE WASTE WATER TREATMENT,
Syracuse Univ., N. Y.
R. C. Faro.
PhD Thesis. 1975. 265 p.

Descriptors: *Sanitary engineering, *Activated sludge, *Lime, Sewage treatment, Sludge treatment, Domestic wastes, Aeration, Biochemical oxygen demand, Phosphorus, Nitrogen, *Waste water treatment.

An investigation was conducted to determine the effects of lime addition to the aeration basin of a heavily loaded activated sludge sewage treatment system. A domestic sewage was treated which was fortified with glucose and nutrient broth. Comparisons between control and lime addition indicated a BOD removal increase from 88.6% to 90.7%. Organic loading increased from 45.6 to 121 lb BOD applied/day/1,000 cu ft. These and other results indicated that lime aided BOD removal at high organic loadings, and high MLSS concentrations seemed to contribute to increased loss of effluent total suspended solids. Lime aided nitrification and phosphorus removal and increased waste sludge production. Cost comparisons indicated that the control treatment was \$0.40/1,000 gallons and lime addition cost was \$0.53/1,000 gallons. (Collins-FIRL)
W77-09601

EVALUATION OF PROCESS DESIGN PARAMETERS FOR PHOSPHORUS REMOVAL FROM DOMESTIC WASTE WATERS BY CHEMICAL CLARIFICATION,
Massachusetts Univ., Amherst.
S. P. Bowen.
PhD Thesis. 1975. 134 p.

Descriptors: *Phosphorus, *Analytical techniques, Coagulation, Flocculation, Sedimentation, Lime, *Waste water treatment, Hydrology, Sludge treatment, Hydrogen ion concentration, Chemical precipitation.
Identifiers: Alum, *Chemical treatment.

The increased use of chemical waste water treatment requires the development of optimum values, and a means for their determination, of design parameters. These parameters include the coagulant, dose, pH, flocculation intensity and duration, and sedimentation time. Alum and lime treatments were the subjects of investigations. Coagulation was studied in the treatment of raw domestic sewage by using jar tests and a column flocculation-sedimentation apparatus. Procedures were developed to determine the effect of coagulant dose and pH interaction on the removal of total phosphorus, suspended solids, turbidity, and total organic carbon. Results showed that alum coagulation produces optimum removal at a dose of about 175 milligrams/liter and a pH of 5.9. Small variations produce large alterations in pollutant removal. There was no optimum dosage for lime treatment coagulation and pollutant removal increased as the dose and pH increased. Coagulation at low lime dose, the use of ferric iron as a coagulant aid and sludge recycling were also studied. Studies on the effect of flocculation mixing intensity and sedimentation time on pollutant removal using the above data indicated that flocculation intensity was relatively unimportant. Overflow rate, dose, and pH for lime and alum produced enough energy to prevent floc settling during flocculation. A lighter, slower floc was produced by alum and alum coagulated water overflow rates must be lower to produce comparable results. Hydraulic variations more easily upset alum floc than lime floc. Alum sludge was more voluminous and more difficult to dewater than that of lime. (Collins-FIRL)
W77-09602

WASTEWATER TREATMENT BY NATURAL AND ARTIFICIAL MARSHES,
Wisconsin Univ., Oshkosh.
F. L. Spangler, W. E. Sloey, and C. W. Fetter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 992, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Technology Series EPA-600/2-76-207, September 1976. 182 p. 9 fig, 33 tab, 168 ref, 6 append. 1BC611. EPA R803794 and S801042.

Descriptors: *Waste water treatment, *Marshes, Marsh plants, Nutrient removal, Phosphorus, Bulrushes, Pilot plants, Harvesting, Model studies, *Wisconsin.
Identifiers: Brillion Marsh(Wis).

The uses of artificial and natural marshes as purifiers of municipal treatment plant effluent was investigated at various sites in Wisconsin. Harvesting plants was not a practical phosphorus removal technique as only a small portion of the phosphorus retained by a marsh system is incorporated into harvestable plant tissue, and then only in summer. The level of water quality improvement attained suggests that the process may be acceptable for polishing effluent from septic tanks of single or small clusters of buildings. Marshes remove phosphorus during the growing season but release it at other times, thus acting as buffers which may be managed to advantage. The natural marsh was moderately effective in removing phosphorus during the growing season but the annual phosphorus output was about equal to the input. Average concentrations of orthophosphate, total phosphorus, conductivity, and total solids were reduced by 13% or less by passage through some 1900 m of Brillion Marsh. The phosphorus concentration in water draining from the marsh ranged from a low of 0.43 mg/l in September to a high of 11.85 mg/l in July, and did not follow any discernable pattern related either to temperature,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

rainfall or season. Reduction of most parameters did not vary when primary or secondary effluent was treated by a marsh. (Auen-Wisconsin)
W77-09606

CONTINUOUS ON-LINE MONITORING OF TOTAL ORGANIC CARBON,
Air Force Civil Engineering Center, Tyndall AFB, Fla.
For primary bibliographic entry see Field 5A.
W77-09635

WATER SYSTEM VIRUS DETECTION,
Organon Diagnostics, El Monte, Calif.
For primary bibliographic entry see Field 5A.
W77-09636

SOIL TEMPERATURES AND HEAT LOSS FOR A HOT PIPE NETWORK BURIED IN IRRIGATED SOIL,
Energy Resources Co., Cambridge, Mass.
J. E. Alpert, S. C. VanDemark, D. D. Fritton, and D. R. DeWalle.
Journal of Environmental Quality, Vol. 5, No. 4, p 406-405, October-December 1976. 5 fig, 3 tab, 15 ref.

Descriptors: *Heat, *Temperature, *Waste water disposal, *Soil temperature, Irrigation, Irrigation effects, Thermal conductivity, Heat flow, Model studies.
Identifiers: Waste water irrigation.

A 0.09-ha field prototype of a simultaneous waste heat and waste water disposal system was constructed and instrumented. Data are reported for soil, pipe, soil surface, and air temperatures; heat loss (0.068-0.117 cal cm⁻² min⁻¹); and soil thermal conductivity (3.61-5.63 mcal cm sec degrees C⁻¹). The data are used to evaluate the heat flow theory which is currently being used to predict the land area required for waste heat disposal with a buried hot water pipe network. Predicted heat loss was consistently lower than experimental heat losses. The results of the experiment indicate that substantial improvements need be made in the existing theory to account for the transient heat flow and heat storage. Research is currently being conducted to develop better predictive models. (Skogerboe-Colorado State)
W77-09654

THE RENOVATION AND RE-USE OF WASTE-WATER,
National Inst. for Water Research, Pretoria, (South Africa).
G. G. Cillie.
Construction in Southern Africa, Vol 21, No 4, p 55-73, July 1976. 4 fig, 9 ref.

Descriptors: Water resources, *Water reuse, *Waste water treatment, Africa, Costs, Cooling water, Heavy metals, Sewage treatment, *Recycling, Water quality, Potable water, Pollution abatement, Pathogens, Industrial water, Steam, Nitrogen, Phosphorus, Pulp wastes, Cement.
Identifiers: Stander plant, Wastewater treatment plant(South Africa), Windhoek wastewater treatment plant(South Africa), *South Africa.

Current re-use practice, available processes for renovating effluents, and the need for further research are discussed. Direct re-use of effluents provides a positive answer to the demand for prevention of pollution, particularly in the upgrading of secondary purified sewage effluents. It is also an important augmentation system for producing water conforming to the quality requirements for a wide range of uses, and further constitutes an economically attractive method of providing a new source of water. The main problems presently restricting the direct re-use of wastewater are the economics of removing

residual impurities after conventional sewage treatment, and the scrupulous destruction of toxicants and pathogens. Techniques for wastewater reclamation are discussed in detail, including the removal of nitrogenous compounds, phosphorus compounds, heavy metals, residual organic compounds, dissolved organic solids, and pathogens. Current re-use practices in South Africa include pasturage irrigation, power station cooling purposes, steam generation, in paper manufacture, the chemical industry, and cement manufacture, and for domestic purposes. The Winhoek and Stander purification plants are discussed, with detailed descriptions of the processes involved. (So. African Water Info Center).
W77-09686

DURBAN TUNNELS UNDER THE MICROSCOPE,
Durban City Engineers Dept. (South Africa).
For primary bibliographic entry see Field 8A.
W77-09689

TREATMENT OF DENIM TEXTILE MILL WASTEWATERS: NEUTRALIZATION AND COLOR REMOVAL,
Noonan (R.S.), Inc. of South Carolina, Greenville. C. R. Fronberger, and M. J. Pollock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 478, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Protection Technology Series, Report EPA-600/2-76-133, May, 1976. 113 p, 1 append, 23 fig, 39 ref, 40 tab.

Descriptors: *Textiles, *Waste water treatment, *Adsorption, *Water purification, *Neutralization, Fly ash, Color, Biochemical oxygen demand, Chemical oxygen demand, Wastes, *Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Calcium hydroxide, Carbon dioxide, Water pollution control, Coagulation, Flocculation, Separation techniques, Sludge.
Identifiers: Flue gases, Aluminum sulfate, Sulfur dioxide, Color removal(Water), *Fly ash absorption.

A description is given of a bench-scale investigation using fly ash adsorption and chemical clarification techniques to remove color from indigo and sulfur dyeing waste waters from a denim textile mill. The investigation also included a feasibility study of flue gas wet scrubbing techniques for neutralizing caustic waste waters. The adsorption studies demonstrated that fly ash from a coal-fired boiler can adsorb and subsequently remove color, 5-day BOD, and COD from biologically treated domestic and dyeing process waste waters. The limited adsorption capacity of the fly ash and problems related to fly ash-waste water contact made full-scale application impractical. The chemical clarification studies included investigation of 11 coagulants, chemical recycle, and various parameters associated with sludge handling and disposal. The studies showed that calcium hydroxide or aluminum sulfate could successfully remove color and produce a supernatant suitable for recycling. The practicality of using coal-fired boiler flue gases to neutralize caustic waste waters was demonstrated in full-scale tests. Caustic waste waters were used with a conventional wet scrubber to neutralize the waste waters by sulfur dioxide and carbon dioxide adsorption from the flue gas while simultaneously reducing the particulate emissions. (Witt-IPC)
W77-09724

RELATIONSHIP OF EFFLUENT LIMITATIONS TO FUTURE PULP MILL CLOSURES,
Environmental Protection Agency, Seattle, Wash. R. L. Coughlin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-243 811, Price codes: A06 in paper copy, A01 in microfiche.

EPA Working Paper No. 88, 100 p, December, 1972. 2 fig, 33 tab.

Descriptors: *Pulp and paper industry, *Water pollution control, *Economics, Regulation, Pollution abatement, Water pollution sources, Pacific Northwest U.S., Biochemical oxygen, Capital costs, Operating costs, Costs, Waste water treatment, Treatment facilities, Waste water(Pollution), *Industrial wastes, Pulp wastes, *Water reuse, *Pulp wastes, Recycling.
Identifiers: *Mill closures.

The growth of the Pacific Northwest wood pulp industry will be constrained in the future by the relatively complete utilization of raw materials that already exists. The industry is undergoing a process of concentration that features vertical integration of forest products output. Daily waste discharges from pulp and paper production amounts to almost 1,000,000,000 gallons of water, more than 3,500,000 pounds of 5-day BOD, and 1,300,000 pounds of settleable, floating and suspended solids. Costs of treating wastes vary with the volume of water to be treated, concentration, specific gravity, and rate of decay of pollutants to be reduced, and the degree of waste reduction required. Mills in the Pacific Northwest have invested about \$96,000,000 (1967 purchasing power) in waste treatment by August, 1972, and were incurring more than \$18,000,000/year in waste treatment costs. To achieve the equivalent of secondary waste treatment will require the investment of another \$82,000,000 and add annual costs of \$13,000,000. Substituting the best practicable control technology for the more general technological requirements utilized under prior law may add more than \$90,000,000 to the region's pulp mills investment requirements over the next 5 years and about \$12,000,000 (\$1.70/ton of output) to annual costs. Although pulp mill closures anticipated over the next 5 years will be largely due to economic forces, water pollution control will play a part in such closures by (1) reinforcing competitive advantages, and (2) modifying the timing and purpose of investment programs. Two of the region's pulp mills will almost certainly close by July 1, 1977, two more have a definite probability of closure, and closure is possible though less likely in two other cases. (Witt-IPC)
W77-09727

FIBERBOARD MILL RECYCLES WATER.

H. R. Fraser.
World Wood, Vol. 17, No. 7, p 20-22, June, 1976. 2 fig, 3 illus.

Descriptors: *Water reuse, *Pulp and paper industry, Water conservation, Europe, Costs, *Recycling, Water pollution control, Foreign countries, Water pollution sources, Industrial water, Economics, *Pulp wastes.
Identifiers: Hardboard, Insulation board, Closed systems, *France.

The successful conversion to closed-circuit operation of a wet-process fiberboard mill was first achieved in France. This article describes briefly what was done and some of the environmental and cost factors of recycling process water for pollution control in a wet-process building board mill. Overflows from the mat former and press in the (high-density) hardboard line and from the web former of the (medium- or low-density) insulating board line are recycled to the defiberizer. The mill includes a surge pond large enough to hold all the process water. The cost of installing the closed system was 2,500,000 French francs (U.S. \$540,000). (Witt-IPC)
W77-09728

BROWN (CO.) RECYCLES DE-INKING WATER ON TISSUE-GRADE PRODUCTS,
J. P. Hanson.
Pulp and Paper, Vol. 51, No. 1, p 136-138, January, 1977. 1 fig, 6 illus.

Descriptors: *Pulp wastes, *Waste water treatment, *Water reuse, Industrial water, Pulp and paper industry, Suspended solids, Biochemical oxygen demand, *Recycling, Dissolved solids, Foaming, Slime, Chlorine, Scaling, Calcium, Silica, Wisconsin, Water pollution sources, Wastes, Industrial wastes, Waste treatment, Additives.
Identifiers: Waste paper, Tissue papers, Sulfuric acid, Aluminum sulfate, Foam inhibitors, Silicides, Corrosion inhibitors, Clarifiers.

Brown Co. (Eau Claire, Wis.), which produces 150 tons/day of absorbent tissue products from 100% de-inked waste paper, is recycling about 85% of its mill process water. Sulfuric acid, Aluminum sulfate, an anionic polymer (not identified), and activated silica are added to the process water, and the effluent is treated in a primary clarifier. Suspended-solids removal averages 94-95%, and BOD removal is 50-60%. Recycling treated water raised the in-mill dissolved solids level by a factor of 3 to 1500-1700 ppm. BOD increased from 80-100 ppm to 200-250 ppm. Foaming during the de-inking process is prevented by adding a defoamer in the water-supply tank. Slime growth is controlled by maintaining a chlorine residual of 0.2-0.3 ppm in the clarified water. Calcium scaling the screw extractors was reduced with chelating agents and by switching from calcium to sodium hypochlorite bleach. Two additional Voith Morden flotation cells and a secondary activated sludge treatment system will be added during 1977. (Witt-IPC)
 W77-09732

APPLICATION OF REVERSE OSMOSIS AND ULTRAFILTRATION TO THE PURIFICATION OF PULP AND PAPER INDUSTRY EFFLUENTS (ZASTOSOWANIE ODWROCONEJ OSMOZY I ULTRAFILTRACJI DO OCZYSZCZANIA SCIEKOW Z PRZEMYSŁU CELULOZOWO-PAPIERNICZEGO).

Instytut Inżynierii Ochrony Środowiska Politechniki Śląskiej, Gliwice (Poland).
 M. Bodzek, O. Kominek, E. Kowalska, and J. Zielinski.

Przegląd Papierniczy, Vol. 32, No. 12, p 466-472, December, 1976, 3 fig, 45 ref, 4 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Reverse osmosis, Wastes, *Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Costs, Water pollution control, Membrane processes, Water quality control.
Identifiers: *Ultrafiltration.

This article constitutes an introduction to a series of research reports on the use of reverse osmosis and ultrafiltration for the purification of pulp and paper industry effluent. The principles of the two methods are outlined, and pertinent literature on the applications of reverse osmosis ultrafiltration to the purification of effluents is reviewed. Despite the still high costs, these two techniques, combined with preliminary purification, appear promising from the viewpoint of chemical recovery and the introduction of closed water cycles. (Stapinski-IPC)
 W77-09733

HOW TO REDUCE WATER AND RAW MATERIAL CONSUMPTION IN PAPERMAKING (COME RIDURRE I CONSUMI D'ACQUA E DI MATERIE PRIME IN CARTIERA).

Cariere Ambrogio Binda S.p.A., Milan (Italy).
 For primary bibliographic entry see Field 3E.
 W77-09738

CLOSED-CYCLE MILL ELIMINATES POLLUTION WHILE ALSO SAVING MONEY.
 For primary bibliographic entry see Field 3E.
 W77-09740

CHLORINATION REACTIONS OF FULVIC ACIDS IN NATURAL WATERS,
 Municipal Water Works of Rotterdam (Netherlands).
 For primary bibliographic entry see Field 5F.
 W77-09741

ACTIVATED CARBON ADSORPTION PROCESS FOR PURIFICATION OF TEXTILE WASTE WATERS,
 McGill Univ., Montreal (Quebec). Dept. of Chemical Engineering.
 C. Roy, and B. Volesky.

In: Book of Papers, International Technical Conference, American Association of Textile Colorists and Chemists, October 13-15, 1976, Montreal, Quebec, Canada, p 241-255. 8 fig, 61 ref, 1 tab.

Descriptors: *Textiles, *Activated carbon, *Waste water treatment, Dyes, Dye releases, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, *Adsorption, Sludge, Capital costs, Color, Odor, Water purification, Operation and maintenance, Effluents, Toxicity, Waste treatment.

Until recently, biological oxidation was predominant in the treatment of textile waste waters. Its application to changing dyehouse effluents, however, has recently been widely discussed. Several advanced techniques have been proposed as alternatives to conventional treatment, specifically adsorption with activated carbon. Adsorption as a unit process offers many advantages compared to conventional biological processes; the adsorption system requires approximately one-seventh the land required for a biological process; no secondary sludge is produced; and even highly toxic wastes can be easily processed. The adsorption system allows flexibility in design and operation, producing esthetically effluent, free of color and odor, at lower capital investment. Treated effluent is suitable for reuse. (Sykes-IPC)
 W77-09744

CHARACTERIZATION AND TREATMENT OF TEXTILE DYEING WASTEWATERS,
 Crompton and Knowles Corp., Reading, Pa.
 R. H. Horning.

In: Book of Papers, International Technical Conference, American Association of Textile Colorists and Chemists, October 13-15, 1976, Montreal, Quebec, Canada, p 100-104. 3 ref, 5 tab.

Descriptors: *Textiles, *Waste water treatment, *Dyes, Effluents, Dye releases, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Dyes, Biological treatment, Carbon, Adsorption, Oxidation, Coagulation, Biochemical oxygen demand, Color, Activated carbon, Waste identification.
Identifiers: Total organic carbon, Aluminum sulfate, Vat dyes, Disperse dyes, Reactive dyes, Basic dyes.

This study was conducted to characterize waste waters from textile dyeing operations; to evaluate biological oxidation, carbon adsorption, chemical oxidation, and chemical coagulation as treatment methods for selected dyeing waste waters; and to examine at the laboratory scale several combined methods as a first step in the development of treatments for textile dyeing waste waters. Biological treatment of dyeing effluents was effective for the removal of 5-day BOD and reduction of total organic carbon, but was not too effective for decolorization. Good decolorization of these waste waters could be accomplished either by coagulation with alum or by treatment with powdered activated carbon. Carbon treatment was not very effective with vat dyes and disperse dyes, but performed better than alum for reactive and basic dyes. Some inhibition of nitrification was observed for many of the samples examined. (Sykes-IPC)
 W77-09745

WATER REUSE IN A PAPER REPROCESSING PLANT,

Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
 L. E. Streebin, G. W. Reid, P. Law, and C. Hogan.
 Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 232, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Technology Series, Report EPA-600/2-76-232, October, 1976. 93 p, 1 fig, 9 tab, 74 ref, 5 append.

Descriptors: *Pulp and paper industry, *Water reuse, Water conservation, Slime, Corrosion control, *Oklahoma, Roofing materials, Pulp wastes, Industrial wastes, Water pollution sources, Economics, Water supply, Costs, *Waste water treatment, Industrial wastes, Wastes, Water pollution sources.
Identifiers: Waste paper, Paper machines, Roofing felts.

The feasibility of water reuse was explored at Big Chief Roofing Co. (Ardmore, Oklahoma), a paper-reprocessing mill manufacturing organic felt (most of which is saturated with asphalt and converted to shingles and other roofing products). Before the project began, the mill was discharging 7.89 liters/second (125 gal/min). Normal operation is now zero discharge, with approximately 0.76 liters/second (12 gal/min). Normal operation is now zero discharge, with approximately 0.76 liters/second (12 gal/min) of fresh water replacing evaporative losses. A favorable cost/benefit ratio experienced at the mill demonstrates advantages of in-plant control over end-of-pipe treatment. Economic benefits observed during zero-discharge operation include reduced water supply costs, reduced waste water treatment costs, improved yield, improved drainage, and greater dryer-section capacity due to increased operating temperatures, and resultant increased production. The benefits were partially offset by shorter felt lives, increased corrosion and slime control costs, and process modification cost. No degradation of production quality was observed. (Witt-IPC)
 W77-09757

PAPER MILL WASTEWATER TREATMENT BY MICROTRAINING,
 Strathmore Paper Co., Turners Falls, Mass.
 F. R. Bliss.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 265, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Technology Series, Report EPA-600/2-76-252, September, 1976. 128 p, 43 fig, 12 tab, 8 ref.

Descriptors: *Pulp wastes, *Waste water treatment, *Treatment facilities, Waste treatment, Wastes, Water pollution sources, Water pollution treatment, Suspended solids, Color, Biochemical oxygen demand, Construction costs, Operating costs, Costs, Operation and maintenance, Coagulation, Flocculation, *Massachusetts, Turbidity, Filtration.
Identifiers: *Microtraining (Treatment).

Strathmore Paper Company and the adjacent Esleek Manufacturing Company in Turners Falls, Massachusetts, have constructed a joint industrial waste treatment plant. The facility, consisting of two microtrainers preceded by coagulation and flocculation, removes suspended solids, turbidity, color, and BOD from an average 1,800,000 gal/day of waste water from the two mills. Plant operating efficiencies over the past year indicated substantial removal of the suspended solids and 5-day BOD. Effluent turbidities averages less than 30 Jackson turbidity units. The construction cost of the treatment facility was \$689,000. First-year operating costs, including wages, power, supplies, chemicals, microfabrics, and maintenance totaled \$36,175, which is approximately equivalent to \$1.50/ton of paper produced. The operation of the treatment facility and some of the problems en-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

countered in establishing the routine operation of the plant are discussed. (Witt-IPC)
W77-09758

TREATING WOOD PRESERVING PLANT WASTEWATER BY CHEMICAL AND BIOLOGICAL METHODS

Environmental Science and Engineering, Inc., Gainesville, Fla.
J. T. White, T. A. Bursztynsky, J. D. Crane, and R. H. Jones.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 454, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Technology Series, Report EPA-600/2-76-231, September, 1976. 108 p, 21 fig, 23 tab, 72 ref, append.

Descriptors: *Wood preservatives(Pesticides), *Waste water treatment, *Activated sludge, *Chlorination, *Phenols, Aromatic compounds, Organic compounds, Chemical wastes, *Industrial wastes, Water pollution sources, Creosote, Biochemical oxygen demand, Chemical oxygen demand, Waste treatment, Chlorinated hydrocarbon pesticides, *Biological treatment, Illinois. Identifiers: *Pentachlorophenol, *Chemical treatment.

A completely mixed activated sludge system was designed for the Koppers Company wood preserving plant at Carbondale, Illinois, with an average daily waste flow of 27,000 liters/day (7,150 gal/day), a BOD concentration of 1,100 mg/liter, and a phenol concentration of 120 mg/liter. Included in the design were capabilities for prechlorination and post-chlorination. The activated sludge system alone was capable of removing 90% of the BOD, 75% of the COD, and 99% of the phenol, and 76% of the pentachlorophenol. Shock loadings had minor effects on BOD and COD removals but reduced the phenol removal and completely prevented pentachlorophenol removal. Post-chlorination dosages of over 50 mg/liter resulted in reductions of 50 and 52% for phenol and pentachlorophenol, respectively. There was no reduction of COD. Laboratory prechlorination studies showed removal of phenol and pentachlorophenol at chlorine dosages in excess of 250 mg/liter. (Witt-IPC)
W77-09759

RESEARCH AND DEVELOPMENT OF AN ELECTROCHEMICAL BIOCIDIC, FINAL REPORT

Life Systems, Inc., Cleveland, Ohio.
G. G. See, C. A. Bode, and K. K. Kachela.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A018 176, Price codes: A06 in paper copy, A01 in microfiche. Report to Army Medical Research and Development Command, October, 1975. 106 p., 18 tab., 41 fig., 52 ref.

Descriptors: *Sewage treatment, Waste treatment, *Waste water treatment, *Water purification, *Water treatment, *Disinfection, *Electrochemistry, Bacteria, *Microorganisms, Viruses, Yeasts, Coliforms, Bioassays, Methodology, *Laboratory equipment, E coli, Pseudomonas. Identifiers: *Electrooxidation, *Biocides, Water electrolysis, *Electrochemical biocides, Klebsiella, Saccharomyces.

The development and preliminary characterization of an electrolytic technique for destruction of microorganisms in potable and waste water were successfully completed. The technique has been termed the 'Electrochemical Biocide' process and employs low level cyclic voltages at chemically inert electrodes to pass an alternating current through the process water. The program was directed toward (a) expanding the design of the electrochemical biocide reactor, (b) determining the engineering parameters which affect process

effectiveness and efficiency and establishing hypotheses for the microorganism kill mechanisms(s), and (c) preparing recommendations for scaling the process to both United States Army Medical Research and Development Command (USAMRDC) and the National Aeronautics and Space Administration (NASA) requirements. Described are the experimental hardware, the methodology and microorganism kill results with three bacteria: (*Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*) two viruses (Polio I and Coxsacki B), one yeast (*Saccharomyces cerevisiae*), and the normal flora of microorganisms found in domestic raw settled sewage. A literature search was conducted on prior research and development efforts related to the electrolytic disinfection of water and waste water. (Katz)
W77-09771

A STUDY TO EVALUATE THE INTENSITY OF AN ALTERNATE METHODS FOR NEUTRALIZATION OF DOD AIRCRAFT FUEL SPILLS, PHASE I

Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div.

For primary bibliographic entry see Field 5G.
W77-09774

APPLICATION OF THE ROTATING FLIGHTED CYLINDER TO LIVESTOCK WASTE MANAGEMENT

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.

J. R. Miner, and W. E. Verley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 357, Price codes: A02 in paper copy, A01 in microfiche. Oregon Agricultural Experiment Station, Corvallis, Technical Paper No. 3952, March 1975. 18 p, 4 fig, 6 tab, 5 ref. OWRT A-031-ORE(1).

Descriptors: Sedimentation, *Farm wastes, *Waste treatment, *Separation techniques. Identifiers: *Livestock waste management, *Rotating flighted cylinder.

The rotating flighted cylinder was tested as both a solid-liquid separator and as a biological waste treatment device. As a solid-liquid separator, it was demonstrated to be effective in removing settleable particles from a dilute slurry and concentrating them into a low volume concentrated stream. As a biological waste treatment device, it effectively combined primary and secondary waste treatment into a single unit and produced an effluent comparable to that obtained from conventional secondary sewage treatment devices. The main advantages of this device are its mechanical simplicity, low power consumption, and trouble-free operation.
W77-09795

DISTILLATION APPARATUS AND METHOD

For primary bibliographic entry see Field 3A.
W77-09804

METHOD AND APPARATUS FOR AEROBIC SEWAGE TREATMENT

C. E. Traverse.
U.S. Patent No. 4,002,561, 10 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 776, January 11, 1977.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Aerobic treatment, Water pollution control, Septic tanks, Oxygenation, Equipment.

An aerobic sewage treatment method and apparatus for use with a conventional septic system collection tanks has an inlet conduit and an outlet conduit. A separate treatment vessel is mounted

horizontally above the septic tank with a tangential inlet and outlet at opposite ends. The inlet is connected to the output of a pump immersed in the main tank with the outlet from the treatment vessel returning to the septic tank. The vessel contains a baffle to contact floc particles and a way to inject an oxygen-containing gas into the liquid. Because of the configuration of the treatment vessel inlet and outlet and baffle, liquid in the vessel flows tangentially under conditions of hydraulic turbulence with large shear forces generated by the baffle to reduce the floc particle size. Maximum aerobic treatment of the contaminated liquid is achieved by reducing the size of the floc particles in the presence of an oxygen-containing gas. (Sinha-OEIS)
W77-09805

WATER PURIFYING SYSTEMS

For primary bibliographic entry see Field 5F.
W77-09808

DETOXIFICATION OF AQUEOUS WASTE STREAMS CONTAINING CYANIDE

Monsanto Co., St. Louis, Mo. (Assignee).
J. V. Cavender, Jr.
U.S. Patent No. 4,003,833, 4 p, 4 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 954, no 3, p 1203, January 18, 1977.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Water pollution control, Chemical reactions, Water quality control, Chemical wastes. Identifiers: *Cyanide, Formaldehyde.

There are many industrial sources of aqueous cyanide wastes such as electroplating, steel and coke operations and the manufacture of chemicals. According to the invention, aqueous streams containing cyanide in a concentration of the order of up to about 1000 ppm are treated to reduce cyanide content by contacting the streams with formaldehyde and a compound which will generate the HSO₃ ion at a temperature from about 80 to about 135°C while maintaining the pH of the mixture in the range from 8-12 for a period of time sufficient to reduce the cyanide content to less than 1 ppm using a formaldehyde/CN⁻ molar ratio of at least one and an HSO₃/CN⁻ molar ratio from about 1.0 to about 1.5. Operation may be either on a batch or continuous basis. The reaction should be carried out under conditions which provide thorough mixing to achieve uniform composition and temperature, preferably in a reactor equipped for mechanical agitation. (Sinha-OEIS)
W77-09812

METHOD OF TREATING WASTE WATER CONTAINING SURFACTANT AND HEAVY METALS

Lion Fat and Oil Co., Ltd., Tokyo (Japan). (Assignee).

M. Kinoshita, Y. Sekiguchi, and S. Ando.
U.S. Patent No. 4,005,009, 4 p, 1 tab, 10 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1655, January 25, 1977.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Heavy metals, *Separation techniques, Foam separation, Surfactants, Coagulation, Inorganic compounds, *Surfactants.

A method of treating a waste water containing anionic surfactant and heavy metals comprises the steps of: adding a specific inorganic coagulant and a specific salt to the waste water so as to make the respective concentration of inorganic coagulant and inorganic salt in the water be at prescribed levels, adjusting the pH value to be in the range of from 5 to 10 after adding the inorganic coagulant, further adding a cationic coagulant so as to make its concentration be at a prescribed level, and treating the processed waste water through the foam separating process. The method is suitable

for treatment of the industrial waste waters to be discharged from metal refinery works, plating shops and metal processing shops. (Sinha-OEIS) W77-09815

METHOD FOR TREATING EFFLUENT RESULTING FROM THE MANUFACTURE OF SYNTHETIC DYESTUFFS AND RELATED INTERMEDIATE CHEMICALS.
American Color and Chemical Corp., Lock Haven, Pa. (Assignee).
C. D. Sweeney.
U.S. Patent No. 4,005,011, 6 p, 2 fig, 6 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1655, January 25, 1977.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Industrial wastes, Chemical wastes, Dyes, Separation techniques, *Activated carbon, Adsorption, Biological treatment, *Activated sludge.
Identifiers: Recycled carbon.

A method for treating effluent resulting from the manufacture of synthetic dyestuffs and related intermediate chemicals includes a multistage treatment process. The process includes equalization of the effluent followed by the chemical treatment with a material such as lime to reduce levels of heavy metals. The chemically treated effluent is then subjected to clarification to remove the solids and then to further equalization. The further equalized effluent is then passed through carbon adsorption columns to reduce levels of nitrobenzene and the color of the effluent to a predetermined level. The thus treated effluent is then subjected to further treatment where the BOD is reduced using activated sludge and then subjected to further clarification after which it can be discharged back into the ecological system. The spent carbon used in the carbon adsorption is recycled using a carbon regeneration furnace to produce fresh carbon which then may be used in the carbon adsorbers. (Sinha-OEIS) W77-09816

SEMI-IMPERMEABLE MEMBRANES AND THE METHOD FOR THE PREPARATION THEREOF.
Department of the Interior, Washington, D.C. Office of the Secretary.
For primary bibliographic entry see Field 3A. W77-09817

WATER TREATMENT SYSTEM WITH PROLONGED AERATION.
For primary bibliographic entry see Field 5G. W77-09818

AERATING APPARATUS.
For primary bibliographic entry see Field 5G. W77-09819

LIQUID FILTERING APPARATUS.
Thermo-Kinetics, Inc., Greenville, S.C. (Assignee).
F. H. Wyman, and J. E. Chambers.
U.S. Patent No. 4,005,018, 8 p, 7 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1651, January 25, 1977.

Descriptors: *Patents, *Industrial wastes, *Waste water treatment, *Water pollution treatment, Water quality control, *Filtration, Separation techniques, Filters, Water reuse textiles, Pulp and paper industry.

The water used in washer sections of air handling systems of textile and paper mills contains contaminants in large volume necessitating frequent cleaning of the entire system. The filter of this invention operates as a result of the difference in head between the contaminated liquid outside the

hollow filter and the lower level of filtered liquid inside the filter. It has been found that a simplified filter with increased filter area may be achieved by using a continuous medium carrying frame defining an open space within a tank containing the contaminated liquid. By filtering the surrounding liquid from the tank, through the media which is carried by driven squeeze rolls, into the bottom of the filter and removing it while maintaining a liquid level outside the frame higher than the liquid level within the frame, greater filter surface area is provided and a simplified structure with easier operation is afforded. The filter utilizes a single chamber open to the atmosphere within a larger receptacle for receiving the contaminated liquid. The filtered liquid is withdrawn from the lower portion within the filter. (Sinha-OEIS) W77-09820

GRAVITATIONAL SEPARATOR.
Love (L. S.) Associates Ltd., Brampton (Ontario). (Assignee).
J. N. Parlette.
U.S. Patent No. 4,005,019, 26 p, 27 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1658-1659, January 25, 1977.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Industrial wastes, *Settling basins, Aeration, Water purification, *Separation techniques, Sludge, Sludge disposal, Equipment.

A clarifier is described which is used to remove from liquids such as industrial or domestic waste water, suspended particles having a specific gravity greater than that of the liquid in which they are suspended. The resulting mass of settled particles which do not degrade must be removed. The clarifier includes a tank for receiving a liquid to be clarified. The bottom of the tank has an outlet through which material can be removed. A gantry is supported for movement above the surface of liquid in the tank. Gantry drive means are provided to perform repeated passes over the surface. A conveyor device for settled material is submerged and positioned at a clearance above the bottom of the tank. Conveyor drive means are coupled to the support means arranged so that the device moves with the gantry and sweeps over the bottom of the tank. The conveyor device has at least one settled-material contacting surface which, when the device is in operation, moves in a direction transverse to the direction of movement of the gantry so as to move material which has settled on the bottom of the tank in a transverse direction towards the outlet. (Sinha-OEIS) W77-09821

URBAN RUNOFF POLLUTION CONTROL-TECHNOLOGY OVERVIEW.
Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
R. Field, A. N. Tafuri, and H. E. Masters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 452. Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-047, March 1977. 103 p, 23 fig, 17 tab, 273 ref.

Descriptors: *Urban runoff, *Overflows, *Combined sewers, Water quality, *Pollution abatement, Sewage treatment, Waste treatment, Costs, Cost comparisons, Water management(Applied), Waste water treatment.

An overview was presented of methods for handling and treating urban runoff and the pollution problems which result from it. Discharge types considered were combined sewer overflow, storm drainage in separate systems, and overflows from infiltrated sanitary sewers. The report describes completed work, ongoing work, and future work needed to combat wet-weather flow pollution. Various study areas included user assistance tools (instrumentation and computers), management alternatives, collection system control, and storage

and treatment. Highlights were presented from more than 150 research projects. Capital cost comparisons were provided for storm and combined sewer control and treatment. In-line storage in Seattle was used to demonstrate a cost-effective solution for urban runoff pollution control. Cost-effective control alternatives for Des Moines were also considered in comparison with the costs of frequent violations of dissolved oxygen standards. (Collins-FIRL) W77-09823

STORM WATER MANAGEMENT MODEL: LEVEL 1-COMPARATIVE EVALUATION OF STORAGE-TREATMENT AND OTHER MANAGEMENT PRACTICES.
Florida Univ., Gainesville. Dept. of Environmental Engineering Science.
J. P. Heaney, and S. J. Nix.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 571. Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-083, April 1977. 105 p, 24 fig, 13 tab, 18 ref, 2 append.

Descriptors: *Storm water, *Water management(Applied), Drainage systems, Pollution abatement, Analysis, Cost comparisons, Urban runoff, Storage requirements, Water treatment, Evaluation.

A simplified method was presented for the evaluation of management practices in conjunction with storage-treatment means of storm water pollution control. Section 208 planning requires procedures which are simpler than the EPA Storm Water Management Model (SWMM), and four levels of management models were developed. A procedure for the comparison of selected alternative control techniques was presented in this report. Control options included storage and treatment, street sweeping, sewer flushing, and catch-basin cleaning. The graphical solution technique described could evaluate these factors in series and/or in parallel with one another. A reference area, Anytown, U.S.A., with a population of 1,000,000 was incorporated in this evaluation. Final conclusions were based on a control cost function for the study area that presented the optimal means of achieving a desired level of control. Application of the technique to the hypothetical community indicated the mix of treatment, storage, street sweeping, and sewer flushing needed. (Collins-FIRL) W77-09824

TREATMENT OF COMBINED SEWER OVERFLOWS BY HIGH GRADIENT MAGNETIC SEPARATION.
Sala Magnetics, Inc., Cambridge, Mass.
D. M. Allen, R. L. Sargent, and J. A. Oberbauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 935. Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-015, March 1977. 127 p, 23 fig, 18 tab, 15 ref, 6 append.

Descriptors: *Combined sewers, *Overflow, *Separation techniques, *Waste water treatment, Flocculation, Sewage treatment, Filtration, Suspended solids, Biochemical oxygen demand, Coliforms, Coagulation, Hydrogen ion concentration, Performance, Evaluation, Costs, Water purification.
Identifiers: *Magnetic separation, *Combined sewer overflows.

High gradient magnetic separation was evaluated as a treatment for combined sewer overflows (CSO). Bench-scale and continuous pilot plant tests were performed. The method maximized the magnetic forces to increase separation performance. Process efficiency was greatest for removal of suspended solids (98.7%), turbidity (96.3%), apparent color (92.8%), BOD5 (92+%), and fecal coliform bacteria (99.85%). COD removal averaged 74%. The relative importance,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

sensitivities, and interactions of parameters were determined. Removal efficiency was found to have an important relationship to the coagulant and the pH level. Comparisons with other secondary treatment methods proved the system to be substantially more efficient. It was also economically competitive. Other favorable factors included high processing rates, decreased land requirements, and lower chlorine demand. (Collins-FIRL)
W77-09825

CONTINUOUS FILTER PRESS.

Effluent and Water Treatment Journal, Vol 17, No 4, p 199, April, 1977. 1 fig.

Descriptors: *Filters, *Separation techniques, Equipment, Suspended solids, Dewatering, *Sludge treatment, Domestic wastes, Industrial wastes, Polyelectrolytes, Economics, Costs, Mechanical engineering, *Waste water treatment. Identifiers: *Continuous filter press.

A newly developed continuous filter press is described. It consists of a single lower endless belt and a shorter upper belt. Secondary and final dewatering stages are located between the belts. Sludge or slurry was pumped through a feed box with a polyelectrolyte injector and into a rotary drum with a fine mesh surface. About 60% of the total moisture content was drained at this point. Sludge was passed to the belt for dewatering by secondary and final squeeze stages. The final squeeze pressure was adjustable. It is possible for the final moisture content to be in excess of 40% solids. The filtrate can be used for belt washing or it can be discharged for additional treatment. The system can be used for most domestic sewage and water treatment sludges, as well as for industrial effluent and metal hydroxide sludges. Improved stability of polyelectrolytes has contributed to the reduction of costs for the system. Other benefits include simple design, low working speed and built-in variations to pressure, belt speed, sludge and flocculation dose. (Collins-FIRL)
W77-09826

GEAR MOTOR SOLVES PLANT'S NOISE PROBLEM.

For primary bibliographic entry see Field 8C.
W77-09827

SPRAY IRRIGATION-WASTE WATER TREATMENT FACILITY. NORTH BRANCH FIRE DISTRICT NO. 1, WEST DOVER, VERMONT.
Consulting Engineer. Vol 48, No 5, p 86, May, 1977.

Descriptors: *Irrigation, *Treatment facilities, Waste disposal, Activated sludge, Tertiary treatment, Ultimate disposal, Design criteria, Pumps, Chlorination, Dewatering, Storage, Municipal wastes, *Waste water treatment. Identifiers: West Dover(VT), *Spray irrigation, *Land application.

A waste water treatment and disposal system, employing spray irrigation/land application, was completed in West Dover, Vermont. The ski resort community could not afford an expensive, technologically advanced treatment system. Activated sludge treatment and holding ponds were designed. The irrigation and land application portions provided means for tertiary treatment and ultimate disposal. A winter flow of up to 820,000 gallons/day was expected. Spraying could be used in winter because early snowfalls and the loose forest mat prevent frost penetration of soil. The spray field was located on a 55-acre hilly area. Nearly 4 miles of insulated steel spray laterals and a system of 600 fixed point spray nozzles at 25-foot intervals composed the automated system. Treatment facilities were placed in a control building that was designed as a barn. This is the first application of the system in New England. The de-

mands for low-cost operation and maintenance of high quality surface and groundwater resources were met. Construction costs of \$2,050,000 were less than estimates of \$2,110,000. (Collins-FIRL)
W77-09828

PROBLEMS AND SOLUTIONS FOR SLUDGE TREATMENT. PART 2.

National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.

J. E. Smith, Jr.

Water and Sewage Works, Vol 124, No 5, p 81-85, May, 1977. 2 fig, 8 tab, 25 ref.

Descriptors: *Treatment facilities, *Municipal wastes, *Design criteria, *Sludge treatment, Sludge disposal, Chemical treatment, Dewatering, Physical properties, Chemical properties, Polymers, Polyelectrolytes, Lime, Filtration, Equipment, Activated sludge, *Waste water treatment.

Experiments, pilot plants, and municipal treatment facilities are discussed in terms of current sludge treatment methods. Fe(+3), Al(+3), polymers, polyelectrolytes, and ferric chloride were used to test the effects on sludge treated in primary stages by chemical conditioning. Polymer conditioning produced good thickening results, and, with Fe(+3), a dry sludge cake was obtained. For sludge stabilization, lime addition was considered a relatively simple, inexpensive, and quick procedure useful in stabilizing large amounts of sludge. The use of sludge incinerator ash improved dewatering and produced a high-quality filtrate. For filtration, a top-feed rotary vacuum filter, moving belt filter presses, and a pressure filtration installation were studied. Top-feed vacuum filters produced a filter cake discharge that was superior to that of bottom-feed units. Little performance data were available for moving belt filters. Their operation depended on chemical addition, solids loading, and screen mesh size. Pressure filtration experience has been limited in the United States. A Cedar Rapids, Iowa, installation has used this system; treatment efficiencies and operating difficulties are described. (See also W75-10398) (Collins-FIRL)
W77-09829

PILOT-SCALE INVESTIGATIONS INTO THE USE OF RANDOM-PACK PLASTICS FILTER MEDIA IN THE COMPLETE TREATMENT OF SEWAGE.

Aston Univ., Birmingham (England).

A. D. Wheatley, and I. L. Williams.

Water Pollution Control, Vol. 75, No. 4, p 468-486, 1977. 11 fig, 4 tab, 28 ref.

Descriptors: *Packed beds, *Filtration, *Plastics, Performance, Biological treatment, Equipment, Flow, Design, Evaluation, *Filters, Biochemical oxygen demand, Suspended solids, Microorganisms, Nitrification, Organic matter, *Waste water treatment. Identifiers: Plastic filter media.

Two pilot-scale biological filters were used to evaluate a new random-pack plastics filter medium for treating municipal sewage. Two loadings were tested, at 1.2 and 2.4 cu m/cu m d. Results indicated no major difference between the experimental plastic media and mineral media ecology. The number of grazing organisms was influenced by the organic matter levels of the filters. Film accumulation was significantly controlled by macrofauna and microfauna, with the numbers of microfauna being inversely related to the macrofauna. Psychoda and mites were the major macro-invertebrates during the first year of operation. Psychoda and Enchytraeidae were dominant as grazers in the second year. Major microfauna during both years were Opercularia and nematodes. Fungi and bacteria were dominant in the film of the high-rate filter and algae and bacteria

dominated the low-rate filter. While film composition differed, quantity fluctuations were similar in both filters. Changes in ambient temperature and in sewage strength did not directly affect the amount of film in filters. This fluctuation could not be linked to filter performance changes. Average BOD removals were 87% for the low-rate filter and 83% for the high rate filter. Results suggest that a large-scale plant could meet effluent quality standards at the low filter rate. Nitrification was not good, but it was speculated that ammonia removal might be maintained over the long term, especially at the lower flow. (Collins-FIRL)
W77-09830

CONTINUOUS COMPOSTING OF ORGANIC WASTE—BY AUTOMATIC CONTROL OF FERMENTATION TEMPERATURE AND HUMIDITY OF PRODUCT AND CONTROL OF CARBON DIOXIDE OR OXYGEN IN WASTE GASES.

For primary bibliographic entry see Field 5E.
W77-09831

CORROSION AVOIDANCE IN WATER AND SEWAGE PIPELINES.

For primary bibliographic entry see Field 8F.
W77-09832

STATIC CALCULATION OF DRAINAGE CHANNELS AND PIPES (DIE STATISCHE BERECHNUNG VON ENTWASSERUNGSKANALEN UND-LEITUNGEN).

For primary bibliographic entry see Field 8G.
W77-09833

DEMONSTRATING THE FEASIBILITY OF VACUUM AND PRESSURE SEWERS,

C and G Engineering, Salem, Ore.

L. K. Clark, and J. E. Eblen.

Public Works, Vol. 108, No. 4, p 81-84, April, 1977. 1 tab.

Descriptors: *Sewers, *Sewer construction, Costs, Conduits, Equipment, Monitoring, Interceptor sewers, Pumping plants, Excavation, Cities.

Identifiers: *Vacuum sewers, *Pressure sewers.

A study was conducted in Bend, Oregon, to determine the feasibility of using vacuum and pressure sewers. A concurrent study attempted to develop construction techniques other than drilling and blasting for sewers in rocky areas. The pressure sewers were designed to tap septic tank effluent lines upstream from boreholes or trench drainage systems. Multiple residential connections were also investigated. There were three residences on one unit, two on each of three units, and two residences were connected to single pumping installations. The system had a total of eleven service connections. The PVC pressure lines were buried at a depth of no less than three feet. The pumping units included a submersible centrifugal pump (25 gpm) in a 30-inch vertical culvert with a tight cover. Two head conditions were used for the six connections, 25 and 37 feet. Discharge lines had check and gate valves and gates were fitted with extension rods. An alarm system was included, but even in the event of pump failure, liquids back up into the original disposal system and householders are not inconvenienced. Monitoring was at the point of discharge into the trunk sewer. Gravity lines did not require rock excavation. A rock trencher was used to place about 25% of the pressure lines. Operation, maintenance and repair costs are being evaluated. The vacuum system also served eleven residences. The central station drew air from small diameter pipes connected to small sumps that received residential waste water. The waste water was collected by vacuum in a receiving tank and pumped through a pressure line to a force main that terminates in the main interceptor. The system was limited by elevation differences.

Vacuum release valves were built into the collection system, but electrical or hydraulic valves would also work. Sumps were connected to building sewers by a line upstream from the septic tank. Costs for the vacuum system piping were about \$9.75/foot and, for the pressure sewers, about \$5/foot. About 50% of the excavation for the vacuum system was done with the rock trencher. These systems show promise as alternatives to gravity systems in areas requiring excessive underground work in heavily built-up areas, in locations with high groundwater tables, or where buildings are inaccessible for gravity service. (Collins-FIRL)
W77-09834

PVC LINING—THE ANSWER TO CORROSIVE ATTACK BY H₂S IN CONCRETE SEWERS AND STRUCTURES.

For primary bibliographic entry see Field 8G.
W77-09835

GO AHEAD FOR LONG SEA OUTFALL.

Water Services, Vol. 82, No. 973, p 126-127, March, 1977.

Descriptors: *Outfall sewers, Drainage, Monitoring, Testing, Bacteria, Planning, Sewage treatment, Waste disposal, Domestic wastes, Waste water treatment.
Identifiers: Weymouth(England), Portland(England).

After much investigation, the Wessex Water Authority, England, has decided to construct a long sea outfall as part of a drainage system to solve sewage problems in Weymouth and Portland. Further testing and study will determine the optimum location and length of the outfall. Environmental conditions are to be continuously monitored. Tests will be conducted with harmless bacteria to determine the time they take to reach land from the outfall. Sewage is an extreme problem and it is expected that a long outfall discharging into deep waters will provide the most economical solution. Inland treatment facilities would be more expensive and an outfall would be necessary in any case. Total costs for all systems involved are estimated to be about 8.8 million pounds; the outfall will cost 2.4 million pounds of this amount. Construction should begin about 1978. (Collins-FIRL)
W77-09836

CHELLASTON TRUNK FOUL SEWER. SOME INTERESTING ASPECTS OF THE SCHEME, Derby Borough Council (England) Drainage Section.

R. G. Fisher.
Chartered Municipal Engineer, Vol. 104, No. 4, p 53-59, April, 1977. 4 fig, 2 ref.

Descriptors: *Sewers, *Sewage disposal, Analysis, Outfalls, Design criteria, Construction, Treatment, Flow, Odor, Canals.

An increase in the population served by the sewage disposal works in Derby Borough, England, and in projected increased industrial operations created a need for development of a drainage plan. This included abolishing the old system and constructing the new Chellaston trunk foul sewer scheme. The proposed scheme involved a gravity trunk foul sewer to the borough's sewage disposal works, laid to minimum falls with a self-cleaning velocity, and routed through developing areas. This would relieve the existing overloaded system and eliminate five existing pumping stations. Design criteria were chosen to satisfy needs until the year 2000. New residential development was assumed to be on a separate system with standards for domestic properties of 0.23 cubic meters per head/day with 3.5 persons per house, and a maximum discharge of six times dry weather flow allowed for 30 dwellings per hectare. Various

aspects of construction were described. These included solutions to problems created by noise, ground conditions, outfall construction, excavation processes, culvert construction, river crossings, and canal construction. (Collins-FIRL)
W77-09837

CHICAGO PLAN DESIGNED FOR POLLUTION AND FLOOD CONTROL.

For primary bibliographic entry see Field 4A.
W77-09838

DESIGN PROPOSALS FOR SUBMERSIBLE SEWAGE LIFT STATIONS.

For primary bibliographic entry see Field 8C.
W77-09839

PENNSYLVANIA WATER PROJECT PROGRESSES QUICKLY.

Water and Sewage Works, Vol. 124, No. 5, p 73, May, 1977.

Descriptors: *Sewers, *Construction, Planning, Water districts, Equipment, Excavation, Trenches, Performance, Pipes, Hydraulic structures, Pennsylvania.

Identifiers: Valley Forge Joint Sewage Authority(PA).

The Valley Forge Joint Sewerage Authority has been responsible for one of the largest American sewer projects. Nine local governments, six contractors, and seventeen contracts were involved. The project consisted of an \$11 million treatment plant, a new interceptor main, and hundreds of miles of sewer pipe. Construction was 40% ahead of schedule, in spite of simultaneous Bicentennial celebrations. Good planning contributed to this success. Lines across the Valley Forge National Park were completed before the summer of 1976. Sewer construction along highways coincided with low traffic periods. Excavation was accomplished by extendable-boom drills and portable compressors, with dynamite blasting in rocky areas. Community disturbances due to drilling were minimized. About 275-325 linear feet of pipe were laid daily. Project completion was expected to be earlier than the target date set for the fall of 1977. (Collins-FIRL)
W77-09840

CRITICAL AND BRINK DEPTHS IN ELLIPTICAL SEWERS.

For primary bibliographic entry see Field 8B.
W77-09841

CITY OF MINNETONKA WING LAKE TRUNK SEWER: CITY OF MINNETONKA, MINNESOTA.

Consulting Engineer, Vol. 48, No. 5, p 89, May, 1977.

Descriptors: *Sewers, *Sanitary engineering, Construction, Environmental control, Excavation, De-watering, Aquatic life, Conveyance structures, Leaching, Pipes, Minnesota.
Identifiers: Minnetonka(MN).

Fifteen thousand feet of 6 to 24-inch sewer and force main, and a lift station were installed as part of a trunk sewer system in Minnetonka, Minnesota. The installation was to eliminate individual soil adsorption disposal systems and sewage leaching into four lakes. An 18-inch diameter gravity sewer was placed across Wing Lake. The lake was drained and cleaned for pipe installation. Clean water from the city water system was used as refill water. Environmental effects of alternative proposals were considered. Sewer construction adjacent to the lake might have destroyed trees. Excessive groundwater movement could have resulted from trench dewatering. The lake's ability to hold water was in danger of disruption

due to the breakage of bottom seals by excavation. Negative effects on aquatic life were considered when lake dewatering was investigated. Public meetings were conducted, and a biological assay provided information so that final decisions could be made. Inclusion of the public in pre-construction planning avoided possible lawsuits from those disturbed about possible environmental hazards, while providing the best solution to the extreme environmental problem of maintaining an intact lake ecosystem. (Collins-FIRL)
W77-09842

NEW SEWER SYSTEM RESISTS INFILTRATION.

Public Works, Vol. 108, No. 5, p 130, May, 1977.

Descriptors: *Sewers, *Infiltration, Design, *Pipes, Construction materials, Sanitary engineering, Joints(Connections), Chemical properties, Physical properties, *Design criteria, Metal pipes, Plastic pipes, Missouri.
Identifiers: Caruthersville(MO).

Caruthersville, Missouri, has completed a sanitary sewer system which resists infiltration. The city is located along the Mississippi River and has a soil which is mostly river and glacial silt. The area also possesses a high water table. Infiltration-proof piping was needed because of its installation several feet below the water table at several points. The major requirements of piping were tight joints and beam strength which would withstand probable subsurface structural movement. Chemical bonding was used to solve the jointing problems; longer pipe lengths necessitated fewer joints. The choice of a pipe which allowed connection to house lines at random levels and increment was important. About 13,500 feet of 8-inch diameter pipe, 4,000 feet of 10-inch diameter pipe, and 1,400 feet of 12-inch diameter pipe were supplied by the Armco Steel Corporation. Another 5,300 feet of 4 and 6-inch diameter extra-strength, solid wall ABS pipe were used in reconnecting house lines. (Collins-FIRL)
W77-09843

HIGHLY EFFICIENT AERATING SYSTEM—FOR AN ACTIVATED SLUDGE EFFLUENT TREATMENT PLANT, WITH RESTRICTED LIQUID CIRCULATION IN AERATING TANK.

French Patent FR 2311-758. Issued January 1, 1977. Derwent French Patents Abstracts, Vol. Y, No. 11, p D3, April, 1977.

Descriptors: *Patents, *Aeration, *Activated sludge, Treatment facilities, Sewage effluents, Equipment, Pumps, Design, Performance, *Waste water treatment.

A patent was issued for an activated sludge treatment aeration system. Domestic or industrial waste effluents are treated by diffusing an oxygen-containing gas through aerators into an aeration tank containing bacterial sludge. The tank bottom aerators are fixed to a movable platform for continuous motion. Air lift pumps hold the settling sludge in suspension. Baffles limit the circulation of tank contents, but do not interfere with aeration. A portion of the aerated effluent is supplied by a connection with a sedimentation tank while the rest of the separated effluent can be recycled to the aeration tank for solids content regulation. (Collins-FIRL)
W77-09844

WASTE WATER BIOCHEMICAL PURIFICATION CONTROL—BY AUTOMATED DETERMINATION OF CARBON DIOXIDE CONCENTRATION WITH BARIUM HYDROXIDE SOLUTION.

Soviet Patent SU 517-845. Issued August 2, 1976. Soviet Inventions Illustrated, Vol. Y, No. 11, p D1, April, 1977.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Descriptors: *Patents, *Water purification, *Monitoring, *Equipment, *Carbon dioxide, Hydrogen ion concentration, Temperature, Automation, Oxidation, Organic compounds, Gases, Electrodes, *Waste water treatment.

A patent was issued for a method to control biochemical treatment of waste water using automated determination of carbon dioxide concentrations. The carbon dioxide monitor includes a circulating pump, respirometric flask, a vessel of barium hydroxide solution with pH meter electrodes and temperature sensor, automatic titration, and a digital analogue transducer with a register. The barium hydroxide solution is kept constant. Carbon dioxide production is monitored during biological oxidation of organic compounds in waste water. The carbon dioxide gas reacts with the barium hydroxide to create a pH change while the temperature is monitored. A reagent flows to a dispenser to keep the pH at a constant value. (Collins-FIRL)
W77-09845

RECYCLING OF ALUM USED FOR PHOSPHORUS REMOVAL IN DOMESTIC WASTE WATER TREATMENT.
Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
D. A. Cornwell, and J. Zoltek, Jr.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 600-612, April, 1977. 6 fig, 4 tab, 21 ref.

Descriptors: *Recycling, *Phosphorus, *Separation techniques, Domestic water, Coagulation, Chemical treatment, Hydrogen ion concentration, Treatment facilities, Economics, *Waste water treatment.
Identifiers: *Alum.

A solvent extraction process was developed for alum recovery. The product was phosphorus-free and the same concentration as commercial liquid alum. An equal molar mixture of mono- and di(2-ethylhexyl) phosphoric acid was the most efficient extractant for aluminum recovery. Equilibrium curves were developed which could be used for countercurrent extraction systems design on the same scale that the curves were first developed. Aluminum recovery was 89-95%. The process necessitated low sludge flows and small detention times which would result in low capital costs. The process should be applicable to either large or small treatment facilities, but has thus far been tested only at the laboratory scale. Benefits include ease of operation, small amounts of required capital outlay, and a large decrease in sludge volume. (Collins-FIRL)
W77-09847

NITROGEN CONTROL: DESIGN CONSIDERATIONS FOR SUPPORTED GROWTH SYSTEMS.
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
K. L. Murphy, P. M. Sutton, R. W. Wilson, and B. E. Jank.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 549-557, April, 1977. 11 fig, 4 tab, 10 ref.

Descriptors: *Nitrogen, *Control, *Design criteria, *Biological treatment, Microorganisms, Pilot plants, Treatment facilities, Nitrification, Denitrification, Analysis, *Waste water treatment.

A review is presented of design criteria for nitrogen control in two supported growth biological reactors, a rotating biological contactor (RBC) and a submerged packed column (SPC). Nitrification and denitrification pilot plant studies were conducted with municipal waste water. The RBC process produced efficient and predictable TKN removal at all temperatures normally found in municipal waste water treatment. It was concluded that the nitrification rate in the RBC was not a

function of filterable TKN concentrations. Nitrification in the RBC showed a relatively low temperature sensitivity. Covers should be installed on treatment units in cold climates to reduce icing problems and prevent the reduction of biological activity. Removal of NO₃ + NO₂ - N was efficient and predictable under all temperature conditions with the submerged RBC reactor. Denitrification rates were not a significant function of this concentration. Low suspended solids concentrations were found in the effluent, even without clarification. Packed column reactors containing highly porous media removed significant quantities of NO₃ + NO₂ - N. Inconsistent, unpredictable denitrification efficiencies were produced by non-steady state hydraulic conditions in packed column reactors. The problem was not solved by flushing the system. Such biological reactors were not recommended when high quality effluent is required. (Collins-FIRL)
W77-09848

LOW COST PHOSPHORUS REMOVAL AT RENO-SPARKS, NEVADA.
Kennedy Engineers, Inc., San Francisco, Calif.
L. E. Peirano.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 568-574, April, 1977. 8 fig, 1 tab, 2 ref.

Descriptors: *Phosphorus, *Costs, Biological treatment, *Separation techniques, Lime, Hydrogen ion concentration, Treatment facilities, *Waste water treatment.
Identifiers: Reno(NV), Sparks(NV).

Low cost phosphorus removal by the PhoStrip process has been implemented at Reno-Sparks, Nevada. The process uses activated sludge microorganisms for phosphorus concentration from waste water flow into a small sub-stream. Phosphorus removal by chemical precipitation from this stream is much less expensive than conventional methods. The lime-phosphorus reaction is pH dependent, not stoichiometric. Thus the quantity of lime needed is dependent upon the quantity of liquid treated rather than the quantity of phosphorus contained in the liquid. This factor produces savings. Return activated sludge (RAS) is held under anaerobic conditions to release phosphorus and create a phosphorus-rich supernatant. Phosphorus taken up by microorganisms in the aeration tank is released under anaerobic conditions. The supernatant liquor from this process is fed to the stripping tank where it settles, becomes anaerobic, and releases phosphorus. A portion of the anaerobic RAS, with phosphorus deficient microorganisms and phosphorus rich liquor, is continuously recirculated to the aeration tank. The microorganisms take up phosphorus and the cycle is repeated. Part of the anaerobic RAS is recirculated through the stripping tank so that supernatant from the surface will contain a maximum phosphorus concentration. Control parameters are the biomass quantity moving through the stripping tank, biomass detention time in stripping tank, and the withdrawal rate of supernatant from stripping tank surface. The plant-scale test at the Reno-Sparks treatment facility produced more than 90% phosphorus removal. The PhoStrip process produced a more stable and better settling activated sludge than conventional processes. Savings of \$600-800,000 annually are expected for a 40 mgd treatment capacity. (Collins-FIRL)
W77-09849

ORGANIC MATTER REMOVAL BY POWDERED ACTIVATED CARBON ADDED TO ACTIVATED SLUDGE.
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
F. B. DeWalle, E. S. K. Chian, and E. M. Small.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 593-599, April, 1977. 5 fig, 1 tab, 19 ref.

Descriptors: *Organic matter, *Separation techniques, *Activated carbon, *Activated sludge, Chemical oxygen demand, Biological oxygen demand, Adsorption, Physical properties, Chemical properties, Sedimentation, *Waste water treatment.
Identifiers: Powdered activated carbon(PAC).

Investigations were conducted on organic matter removal through the addition of powdered activated carbon to activated sludge. It was shown that powdered activated carbon added to activated sludge units with 5 and 10 day residence times decreased effluent organic matter concentrations. This was also true when additions were at low equilibrium concentrations. Powdered activated carbon was equally effective at both residence times. Organic matter reductions in the 5-day PAC units were partially biologically mediated. This was possibly attributable to formation of a denser sludge particle. Reduction in concentration of low-molecular-weight amino acids and carbonyl compounds excreted by bacteria during substrate removal is probably due to their restricted diffusion into the solution and subsequent rapid uptake. Removal of organic matter in the 10-day units were of a more physical nature due to removal of an intermediate molecular weight fraction, characterized by aromatic hydroxyl groups. (Collins-FIRL)
W77-09850

NITRIFICATION IN A CHLORINATED ACTIVATED SLUDGE CULTURE.
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Science.
P. F. Strom, and M. S. Finstein.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 584-592, April, 1977. 6 fig, 4 tab, 35 ref.

Descriptors: *Nitrification, *Activated sludge, *Chlorination, Treatment facilities, Performance, Trickling filters, Bacteria, Microorganisms, Evaluation, *Waste water treatment.

The effects of chlorination on nitrification in an activated sludge culture were investigated. A hospital activated sludge treatment plant in Marbaro, New Jersey, was used for the study. It was found that this underloaded activated sludge plant treating institutional waste water nitrified practically all of the ammonium during the first 6-8 hours of treatment. Nitrification was not decreased by the use of chlorination (30-40 milligrams of Cl₂/liter return sludge) for bulking control. Nitrite concentration decreases were attributed to nonbiological reactions with the disinfectant. Laboratory incubations resulted in a nitrification end product accumulation of 1 milligram of nitrate nitrogen/hour/gram MLSS (dry weight). Nitrification rates were not affected by chlorine doses of 0, 5, 15, 25, or 50 mg/liter of return sludge. Total organic carbon and BOD removal were not significantly affected by these chlorine doses. MLSS settleability was improved. It was concluded that although chlorination can solve various biological treatment operational problems without harm to nitrification, it may create other undesired effects. (Collins-FIRL)
W77-09851

DISINFECTION OF WASTE WATER BY PHOTODYNAMIC OXIDATION.
Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.
C. P. Gerba, C. Wallis, and J. L. Melnick.
Journal Water Pollution Control Federation, Vol. 49, No. 4, p 575-583, April, 1977. 8 fig, 9 tab, 18 ref.

Descriptors: *Disinfection, *Light, *Oxidation, Pathogenic bacteria, Viruses, Fungi, Toxicity, Dyes, Coliforms, Hydrogen ion concentration, Temperature, Organic matter, *Waste water treatment.
Identifiers: *Photoinactivation.

Waste water disinfection by photodynamic oxidation was investigated. Methylene blue was chosen as the test dye from those which render viruses, bacteria, and fungi sensitive to damage and destruction by light in the presence of molecular oxygen. The amount of coliforms and poliovirus inactivated by methylene blue photodynamic oxidation was affected by dye concentration, temperature, pH, and sensitization time. A pH of at least 9.0 was required, with the greatest effect on sensitization occurring between pH 9.5 and 10.0. Other heterocyclic dyes are capable of sensitizing viruses in a neutral pH range, but were too expensive or not available in bulk. Optimal dye concentrations for viral photoinactivation were between 1 and 10 mg/liter. A range of 1 to 5 mg/liter would be preferable because higher concentrations absorbed most of the light near the surface. Light would penetrate deeper with lower concentrations and more light exposure would be necessary to inactivate given amounts of viruses than at higher dye concentrations. Organic matter concentrations did not affect the dye action or microorganisms. However, ultraviolet light would be ineffective for effluents with high organic matter concentrations. Wavelengths of 670 nm are not absorbed by organics and can penetrate to greater depths. Turbidity has an effect on visible light penetration into fluids, but turbidities of 4.5 to 10 JTU did not affect coliform or poliovirus inactivation. Photoinactivation would be most advantageous in advanced waste water treatment plants where high effluent quality is required. Plants using lime flocculation could be easily adapted to this process, as well as those with high pH levels for ammonia stripping. Dye removal by activated carbon would be productive for land disposal sites. The use of energy from sunlight was a practical alternative to artificial light, particularly for areas with year round daylight. The process has its greatest applicability in systems which require large reductions of pathogenic bacteria and viruses. (Collins-FIRL)
W77-09852

RAPID SAND FILTRATION FOR BEST PRACTICAL TREATMENT OF DOMESTIC WASTE WATER STABILIZATION POND EFFLUENT, Oklahoma Univ. Health Sciences Center, Oklahoma City, D. T. Boatright, and C. H. Lawrence.

Descriptors: *Filtration, *Soil filters, *Oxidation lagoons, Domestic wastes, Biochemical oxygen demand, Coliforms, Economics, Design, Operation, Maintenance, Treatment facilities, Nutrients, Pollution abatement, *Waste water treatment.

Investigations were conducted to determine sand filtration modifications which would permit the use of a compact unit to improve waste stabilization pond effluents. Filtration efficiency, filtration rate, and the length of the filter run were evaluated for a range of sand sizes-0.92, 0.50, 0.35, and 0.17 mm. A 5 to 7 foot hydraulic head, under continuous flow conditions, was used during periods of highest suspended solids concentrations in pond effluent. Efficiency was determined by comparison of influent and effluent BOD₅, suspended solids, and fecal coliform concentrations. Filters of 0.50 to 0.35 mm were successful when operated at rates of 1 to 3 gallons/sq ft/min for minimum filter runs of 5 weeks. Effluents produced met the standards of 30 mg/liter of BOD₅ and suspended solids and 200 fecal coliform/100 ml. Average BOD₅ efficiencies were 70-94%. Reductions of fecal coliform ranged from 92 to 98%. Effluent concentrations were 6-37 mg/liter of BOD₅, 9-43 mg/liter of suspended solids, and 42-173 fecal coliform/100 ml. Towards the lower end of the 0.35-0.50 filter range, efficiency increased and the stability of filtration rates and length of filter run substantially decreased. Filtration efficiency decreased and filtration rates and filter run length were acceptable and stable for the 0.50 millimeter filter size. These units were technically and economically feasible for small communities.

Maintenance requirements were minimal and the system was considered applicable to rural effluents. (Collins-FIRL)
W77-09853

UPGRADING A COMPLEX MIX ACTIVATED SLUDGE WASTEWATER TREATMENT PLANT, Brown and Caldwell, Walnut Creek, Calif. W. R. Uhte.

Descriptors: *Treatment facilities, *Performance, *Activated sludge, Trickling filters, Oxidation lagoons, Industrial wastes, Sedimentation, Aeration, Chlorination, Disinfection, Operations, Equipment, Control, *Waste water treatment.

Modifications have been made to upgrade a complex mix activated sludge treatment plant where effluent suspended solids loadings and coliform MPN counts were near violation levels. The Sacramento County Central Wastewater Treatment Plant processes both domestic and industrial wastes and was subject to heavy organic loads during an approaching canning season. Major problems included an unstable activated sludge process, an inadequate waste solid processing and disposal system, and the unknown magnitude of industrial waste loadings. The first was the subject of this study and contributing factors were: the inability of plant aeration and settling to operate as a single system; inadequate control of return activated sludge (RAS); inability to maintain regulated waste activated sludge (WAS) flow rates; no chemical feed facilities to improve mixed liquor settling and control filamentous growths; insufficient maintenance of DO in aeration tanks; and varying mixed liquor flows to final clarifiers. Primary effluent and RAS were mixed before distribution to aeration bays and all secondary clarifier RAS flows were completely mixed before return to primary effluent. Operation was possible at higher solids levels with lower feed:solids ratios during peak canning load periods. RAS was aided by the installation of two independent RAS pumps at each clarifier. For WAS control an aeration bay was changed into a reaeration bay, the WAS pump discharge header was raised, and a WAS magnetic meter with a higher peak capacity was installed. Ferric chloride and chlorine chemical feed facilities were constructed to provide flexibility during critical operational periods. Hydraulic losses were minimized and the use of equalizing overflow weirs in the aeration tank 'H' produced equal distribution of mixed liquor to the clarifiers. After two years, plant operation was significantly improved. (Collins-FIRL)
W77-09854

AN APPROACH TO REDUCE WATER CONSUMPTION IN NEIGHBORHOODS THROUGH REUSE.

Sir Venkateswara Univ., Tirupati (India). Dept. of Civil Engineering. P. P. Mowli. Indian Journal of Environmental Health, Vol. 18, No. 4, p 299-304, October, 1976. 1 fig, 3 tab, 5 ref.

Descriptors: *Water reuse, *Water demand, Water consumption (Except consumptive use), Domestic water, Water treatment, Water purification, Filtration, Equipment, *Waste water treatment, Urban areas. Identifiers: *India.

A two-year study was conducted in India on the feasibility of waste water reclamation and reuse to lower domestic water consumption. The test site was a college residential area whose water consumption patterns were similar to that of developing upper income neighborhoods. It was suggested that waste water from baths, water closets, and washing could be used for gardening purposes when suitably treated. This would reduce fresh water demands by 20-34% depending upon gardening needs. Design criteria for a successful reuse

scheme included: waste water treatment to a satisfactory level; construction of septic tank and other treatment units adjacent to the water closet and bath; construction of treatment units partially or fully above ground level so that treated effluent could flow into a storage tank; and using hose pipes to transport treated waste water to the plant beds. Open drains would be eliminated. In the test system, septic tank effluent was further treated in reverse filters before storage. Common-wall, compact construction resulted in cost and area savings. Elimination of house drains and head pressure conservation were accomplished by constructing the unit adjacent to the water closet and bath. The final effluent was very clean and had no objectionable odor or color. Hoses were supplied to avoid complaints against direct handling of reclaimed water in gardening applications. (Collins-FIRL)
W77-09855

SEWAGE EJECTORS AVOID MANUAL UNBLOCKING OF PIPES.

For primary bibliographic entry see Field 8C.
W77-09856

HYDROGEN PEROXIDE SUBDUES WASTE WATER PLANT PROBLEMS.

Public Works, Vol. 108, No. 5, p 105, May, 1977.

Descriptors: *Treatment facilities, *Sewers, *Performance, Hydrogen sulfide, Odor, Corrosion control, Chlorine, Dissolved oxygen, Biochemical oxygen demand, Sewers, *Waste water treatment, California. Identifiers: *Hydrogen peroxide treatment (Waste water), Stockton (CA).

Stockton, California, has used hydrogen peroxide to solve several waste water treatment problems. Chlorine usage was reduced, hydrogen sulfide was eliminated, crown corrosion was prevented, and so was the septicity of raw sewage in the force mains. Use of hydrogen peroxide was instituted to prevent odors and concrete sewer corrosion. It was later used to ensure the operation of an overloaded treatment facility until the completion of a higher capacity plant. Prevention of septic waste water was accomplished by hydrogen peroxide addition at three lift stations. This raised DO concentrations at the primary clarifier and kept the wastes fresh. Hydrogen peroxide prevented corrosive H₂S reactions in sewers and completely eliminated the need to use chlorine for odor control. Application of hydrogen peroxide is planned for trunk lines to the new plant which will handle flows having high H₂S and BOD concentrations. (Collins-FIRL)
W77-09858

THURLOCK TEST-BED FOR ICI DEEP SHAFT, B. Appleton. New Civil Engineer, No. 239, p 24-25, April, 1977. 1 fig.

Descriptors: *Aeration, *Treatment facilities, Sanitary engineering, Water purification, Biochemical oxygen demand, Oxygen, Industrial wastes, Domestic wastes, Costs, *Waste water treatment, Bubbles. Identifiers: ICI deep shaft, *Oxygen transfer, Anglian Water Authority (England).

The ICI deep shaft treatment process uses air injection to drive raw sewage down a central shaft and back up the space around the shaft annularly. It then overflows for a final clarification after about 20 circuits. The system creates a longer air bubble contact time to produce a higher oxygen transfer efficiency. Purification rates are several times that of normal aeration and energy needs are reduced. The Thurlock facility of the English Anglian Water Authority will test the process. The 130 meter-deep, 1.86 meter-diameter shaft is expected to remove 7,000 kg of BOD/day from a

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

mixture of industrial and domestic sewage equivalent to a 130,000 population sewage load. Cost comparisons indicated that the 750,000 pounds to be expended would equal the cost of an extended aeration program to treat the normal domestic sewage of a 30,000 population to Royal Commission standard.
W77-09859

VIRUS AND BACTERIA REMOVAL FROM WASTE WATER BY RAPID INFILTRATION THROUGH SOIL

Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
S. A. Schaub, and C. A. Sorber.
Applied and Environmental Microbiology, Vol 33, No 3, p 609-619, March, 1977. 6 fig, 6 tab, 15 ref.

Descriptors: *Viruses, *Bacteria, *Infiltration, *Soil disposal fields, Adsorption, Soil contamination, Water pollution, Groundwater, Separation, Microorganisms, *Waste water treatment.

The removal of viruses and bacteria from waste water by rapid infiltration following land disposal was investigated. The study site was a disposal field which has been operated continuously since 1942. Viral adsorption and enteric indicator bacteria studies were performed. It was found that all soil layers held viruses poorly (in primary effluent) and bacteriophage adsorption was minimal. Viral adsorption was significant, except in high organic content surface layers, when deionized water with metal cation was used. In unrenovated cells, adsorptive sites in upper soil layers were depleted. The f2 bacteriophage stabilized in groundwater at almost 50% of the applied virus concentration. Recovery of enteric viruses was about 10% of the waste water virus concentration. Laboratory tests indicated greater soil adsorption of enterovirus as compared to poliovirus. Indicator bacteria studies indicated a different behavioral pattern. Large concentrations of total coliform, fecal coliform, and fecal streptococcus were retained in surface soils. Bacterial concentrations dropped significantly, declining at slower rates than viruses, in subsequent layers. It was doubtful that adsorption played a large role in these results. Fecal streptococcus in groundwater did not correspond with tracer bacteriophage occurrence. This could be attributed to different migration times and to previous waste water applications. (Collins-FIRL)
W77-09860

NIRMALI SEED—A NATURALLY OCCURRING COAGULANT

Bhagalpur Engineering Coll. (India). Dept. of Civil Engineering.
P. N. Tripathi, M. Chaudhuri, and S. D. Bokil.
Indian Journal of Environmental Health, Vol 18, No 4, p 272-281, October, 1976. 6 fig, 4 tab, 15 ref.

Descriptors: *Polyelectrolytes, *Coagulation, *Flocculation, *Clays, Bacteria, Evaluation, Water purification, Chemical treatment, Separation techniques, *Waste water treatment.
Identifiers: *Nirmali seed(Treatment), India.

Nirmali seeds and nuts have long been used in crushed form to clarify muddy water in India. An extract from the seeds was found to be an anionic polyelectrolyte which was effective as a coagulant and coagulant aid in the clarification of natural turbid water. The two main groups on the polymer were carboxyl and hydroxyl. It was an efficient flocculant for turbidity that was of an inorganic, hydrophobic nature. The extract performed poorly as a flocculant and coagulant for natural biocolloids, such as bacteria. (Collins-FIRL)
W77-09861

WASTE WATER TREATMENT BY ANAEROBIC CONTACT FILTER

National Environmental Engineering Research Inst., Nagpur (India).
A. N. Khan, and R. H. Siddiqui.

Indian Journal of Environmental Health, Vol 18, No 4, p 282-291, October, 1976. 2 fig, 5 tab, 7 ref.

Descriptors: *Aerobic conditions, *Filtration, *Filters, Performance, Evaluation, Bacteria, Costs, Chemical oxygen demand, Liquid wastes, Anaerobic bacteria, Suspended solids, *Waste water treatment, Equipment.
Identifiers: *Anaerobic contact filter.

Laboratory studies were conducted to test the performance of an anaerobic contact filter unit. This was an upflow filter with waste introduced from the bottom. The filter was completely submerged. It contains a stone-filled bed, on which anaerobic microorganisms grow, that allows higher loading rates. Results showed an 80% reduction in applied COD at a loading of 225 pounds of COD/1000 cubic feet/day. Liquid detention time at this loading was 8 hours. The anaerobic contact filter compared favorably with other biological treatment methods. Performance was not significantly improved with a height greater than 4 feet. Treatment of soluble wastes with BOD concentrations as low as 500 mg/liter was feasible and the system was considered as an alternative to septic tanks themselves, or as a secondary treatment method for septic tank effluents in water-logged or compact areas. (Collins-FIRL)
W77-09862

EVALUATION OF CELLULOSE ACETATE MEMBRANES FOR REVERSE OSMOSIS SEPARATION

National Environmental Engineering Research Inst., Nagpur (India).
A. S. Bal, and S. L. Lutade.
Indian Journal of Environmental Health, Vol 18, No 4, p 253-271, October, 1976. 10 fig, 4 tab, 10 ref.

Descriptors: *Reverse osmosis, *Membranes, *Polymers, *Evaluation, Membrane processes, Temperature, Evaporation, Humidity, Physical properties, Chemical properties, Separation techniques, Water purification, *Waste water treatment.
Identifiers: Cellulose acetate membranes.

The performance of cellulose acetate membranes was evaluated for use in reverse osmosis separation. A spread casting solution of cellulose acetate, formamide, and acetone was spread on a suitable surface and allowed to evaporate. The film was immersed in cold water and the formamide was leached away, thus forming a highly porous membrane. Shrinkage was accomplished by heating under water. The membrane was tested to determine the effect of casting parameters such as casting temperature and relative humidity of the casting atmosphere. Results indicated that the most useful casting formula was, by weight, 25% of cellulose acetate, 30% of formamide, and 45% of acetone. Trends relative to temperature indicated an increase in product rate with increased casting temperatures. An increase in percent salt rejection was observed with increasing casting temperatures. Higher percent relative humidities are accomplished by higher flux rates and low rejection through the membrane. With casting temperatures of 23-26°C, a relative humidity of 65-78% produces the most productive membranes. (Collins-FIRL)
W77-09863

PASTEUR V CURIE

The Consulting Engineer, Vol 41, No 4, p 43, 45, April, 1977. 1 fig.

Descriptors: *Irradiation, *Heat treatment, *Fertilizers, Sewage treatment, Sewage disposal, Temperature, Equipment, Sludge disposal, Physical properties, Biological properties, *Waste water treatment.
Identifiers: *Pasteurization.

Sterilization is a necessity before sewage can be used as an agricultural fertilizer. This can be accomplished by either irradiation or pasteurization. A German irradiation plant claims to produce results comparable to those of conventional pasteurization plants. It is composed of a sludge irradiation shaft, a built-in central pipe, and a recirculation system. Components requiring regular inspection and maintenance are remote from radiation sources and are safe during periods of operation. Varied safety measures have been taken and the source rods do not contact the sewage. A closed loop system is provided for cooling and leakage monitoring. The operation is a batch process. Irradiated sludge is discharged to a storage tank for separation of sludge and water. Operation is automatically controlled. A Danish pasteurization plant included mechanical and biological treatment, and anaerobic stabilization of the sludge. The plant treated about 40% of the sludge produced from the related municipal treatment plant. Sludge was passed to a spiral heat exchanger for indirect heat exchange preheating and was dispatched as pasteurized sludge. Radiation doses of 150 krad for 5 minutes was considered adequate for sludge dried to 25% solids and a 500 krad dose at the same exposure time was necessary for sludge dried to 10% solids. This was calculated to equal pasteurization at 80°C for 30 minutes. The pasteurization process with a shorter heating time does not claim complete bacterial destruction, but does destroy salmonella and escherichia bacteria. Operation was at 80°C for 5 minutes. The total bacterial count was reduced by 65-85%. COD was increased 200-300% during pasteurization at 75-85°C and by a minimum 900% at 90-95°C. (Collins-FIRL)
W77-09864

WASTE PURIFICATION PROCESS

Indian Chemical Journal, Vol 11, No 7, p 33, January, 1977.

Descriptors: *Treatment facilities, *Biological treatment, Ammonia, Odor, *Oxygen, *Aeration, Sedimentation, Biochemical oxygen demand, Oxygen demand, Costs, Water purification, *Waste water treatment.

A German installation of the Lindox biological waste water treatment process is described. The treated waste is highly contaminated with ammonia and has a strong odor. The process involves the introduction of waste into a stirred balancing tank and then into a two-stage activation basin. Oxygen is injected by two surface aerators to a concentration of 5-15 mg/liter. Waste is passed through a sedimentation basin and a 99.5% pure effluent is produced for disposal into a river. A 31-hour aeration time produces an effluent with a BOD of 23 mg/liter from an influent BOD of 5230 mg/liter. Specific oxygen demand is about 1.04 kg/kilogram of BOD. Low operating costs are produced from an electrical consumption of 0.32 kilowatt hours/kilogram of BOD. (Collins-FIRL)
W77-09865

OXIDATION DITCH GIVES LOW-COST SECONDARY TREATMENT

The American City and County, Vol 92, No 5, p 87-88, May, 1977. 1 fig, 1 tab.

Descriptors: *Oxidation, *Treatment facilities, *Sewage treatment, Biochemical oxygen demand, Suspension solids, Toxicity, Organic matter, Nitrification, Denitrification, Activated sludge, Separation techniques, *Waste water treatment, *Oxidation lagoons.
Identifiers: Oxidation ditches.

A survey of secondary treatment facilities was conducted in EPA Region VII. Thirty facilities were evaluated for BOD₅, COD, NFS, total P, NH₃-N, TKN, NO₂-NO₃-N, and influent and effluent water temperatures. Activated sludge facilities and oxidation ditches presented the best per-

formance, reaching 99% removals. Trickling filter plants were not as efficient. Nitrogen conversion was used as the measure of optimal performance. At temperatures less than 5°C, properly operated activated sludge plants and oxidation ditches can produce effluents containing less than 0.5 mg/liter of ammonia. Most secondary treatment plants did not perform efficiently. Collected data indicated that oxidation ditches could provide excellent treatment at low costs. These plants did not require highly trained operators for good performance. They could also be designed to provide complete nitrification in the coldest weather and a significant degree of denitrification. Unsatisfactory performance in some oxidation ditches could be traced to problems such as frozen sludge return lines and poor design. (Collins-FIRL) W77-09866

GROWTH OF TULIPS TREATED WITH SLUDGE CONTAINING DEWATERING CHEMICALS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-09867

ELEMENTAL COMPOSITION OF SLUDGE-FERTILIZED CHRYSANTHEMUMS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-09868

HOW SLUDGE CHARACTERISTICS AFFECT INCINERATOR DESIGN,
Hydrosience, Inc., Knoxville, Tenn.
For primary bibliographic entry see Field 5E.
W77-09869

REVIEW AND EVALUATION OF AERATION TANK DESIGN PARAMETERS,
Donohue and Associates, Inc., Waukesha, Wis.
G. A. Gagnon, C. J. Crandall, and A. E. Zanolini.
Journal Water Pollution Control Federation, Vol 49, No 5, p 832-841, May, 1977. 4 fig, 8 tab, 39 ref.

Descriptors: *Aeration, *Treatment facilities, *Design criteria, Storage, Loads(Forces), Biomass, Organic matter, Time, Biochemical oxygen demand, Evaluation, *Waste water treatment.
Identifiers: *Aeration tanks(Design).

The development of aeration tank design parameters was reviewed and these parameters were evaluated. The relationship between detention time and BOD removal has been a widely recognized parameter since the early 1900s. Organic loading per unit of volume and per unit of biomass have recently been recognized as more important parameters, in light of the activated sludge processes developed within the past thirty years. These parameters are more indicative of aeration tank conditions, such as the amount of biomass available for stabilization and the amount of organic matter to be stabilized. This study evaluated the efficiency of an activated sludge treatment plant as a function of three parameters. These were organic loading per unit volume, organic loading per unit of biomass, and organic loading per unit of biomass per unit time. There was no evident correlation between effluent BOD concentration and aeration tank loading in the range of 0.1-0.7 grams of BOD/gram of MLVSS/day. Percent BOD removals increased as aeration tank loading increased. Plant performance was more predictable at loadings above 560 grams of BOD/cu m/day, 0.3 grams of BOD/day/gram of MLVSS per day, and 35 grams of BOD/kg of MLVSS per day, than at lower loadings. Loadings up to 1,120 grams of BOD/cu m/day, 0.7 grams of BOD/gram of MLVSS per day, and 95 grams of BOD/kg of MLVSS per hour/per day produced

BOD removals between 92 and 98%. Operation at these loadings is considered to be within the most effective range. Aeration tank size and construction costs would be reduced by a design for these higher rates. This would also provide the plant operator with a wide range from which to choose the plant loading rate. (Collins-FIRL) W77-09870

CHEMICALLY ASSISTED BIOLOGICAL OXIDATION OF WASTES AND EXCESS SLUDGE,
Oklahoma State Univ., Stillwater. Bioenvironmental Engineering Labs.
A. F. Gaudy, Jr.
Water and Sewage Works, Reference Issue, p 48, 50-52, 54-56, April, 1977. 11 fig, 10 ref.

Descriptors: *Aeration, *Oxidation, *Hydrolysis, *Activated sludge, Metabolism, Effluents, Suspended solids, Waste disposal, Acidity, *Waste water treatment.
Identifiers: *Chemical treatment.

Extended aeration was investigated as a reliable means of producing a quality effluent without creating excessive biological sludge. It has been postulated that a process that did not involve sludge wasting would balance endogenous cellular metabolism and incoming sludge concentration by using the incoming waste for synthesis and growth. This would produce total waste oxidation. Those who have refused this basic theory suggest that any success was due to solids going over the clarifier weir. A three-year investigation was conducted in which effluent was held in a holding tank, centrifuged, and returned to the holding tank to avoid solids being lost over the clarifier weir. The results revealed that neither a balanced condition between autodigestion and new sludge synthesis, nor a steady increase in biological solids concentration occurred. There were periods of solids accumulation and de-accumulation. The de-accumulation period was found to result from autodigestion exceeding sludge accumulation. Experimentation revealed that process malfunction would probably be due to impaired separation in the clarifier. Since centrifugation would not be practical in a field situation, solids would be channeled to the receiving stream. The insoluble portion of microbial cells released upon cell breakage, such as cell walls and membranes, consisted of polymers of compounds which were good substrates. Acid hydrolysis of these materials provided a substrate which was used to initiate autodigestion during de-accumulation periods. Further development of this 'hydrolytic assist' procedure could make extended aeration a more cost-competitive sludge disposal method. (Collins-FIRL) W77-09871

SAFFRON WALDEN OPENS ITS LOW PROFILE SEWAGE WORKS,
J. Pullin.
Surveyor, Vol 149, No 4426, p 3, April, 1977.

Descriptors: *Treatment facilities, *Sewers, Design criteria, Performance, Costs, Screens, Settling basins, Pumps, Filters, Biological treatment, Pumping plants, Sensors, *Waste water treatment.
Identifiers: Saffron Walden(England).

A new treatment plant was opened at Saffron Walden, England. The former facility, located near a park, was overloaded. There was opposition to expansion of the old plant and demands that there be no environmental or aesthetic disturbance created by the new one. The routing of a footpath along the new site was also a problem. A revised design centralized the treatment works on one side of the path and the storm overflow and final effluent treatment area on the other side. Added costs incurred by the redesign have not been determined. High and low level gravity sewer systems provided sewage flow to the new plant. The first was fed by a new relief trunk sewer that intercepted the older

system. The second discharged at the old site where effluent is pumped to the new works. Screenings from the inlet works were disintegrated and returned to the main flow through a detritor. A measuring flume diverted flows exceeding 3 mgd to storm water tanks. A central hopper received settled sludge. Settling tank overflow was mixed with humus tank effluent in the main pumping station and lifted to biological filters. Pump operation was automatically controlled. The biological filters were constructed as four beds. Flow then passed to humus tanks where effluent was divided for passage to the pumping station and recirculation. The remainder of this flow was passed to the river in winter or to microstrainers for polishing in the summer. A sludge consolidation unit received sludge from primary settling tanks. It was then stored for final treatment at a regional sludge center. The plant was constructed to a high architectural standard and its components were compact. (Collins-FIRL) W77-09872

BIOLOGICAL FLUIDIZED-BED TREATMENT FOR BOD AND NITROGEN REMOVAL,
Ecotrol, Inc., Bethpage, N.Y.
J. S. Jeris, R. W. Owens, R. Hickey, and F. Flood.
Journal Water Pollution Control Federation, Vol 49, No 5, p 816-831, May, 1977. 14 fig, 8 tab, 12 ref.

Descriptors: *Filtration, *Biological treatment, *Biochemical oxygen demand, *Nitrogen, Filters, Biomass, Pilot plants, Oxygen, Suspended solids, Sludge, Nitrification, Ammonia, Dissolved oxygen, Hydrogen ion concentration, Denitrification, Evaluation, *Waste water treatment, Treatment facilities.
Identifiers: *Fluidized-bed treatment.

Results of BOD and nitrogen removal studies in three fluidized bed pilot plants were summarized. The basic operation consists of an upward flow of waste water through a sand bed at a velocity which imparts motion to the sand. Test facility sizes ranged from 40,000 gpd for denitrification to 80,000 gpd for carbonaceous BOD removal and nitrification. Systems were operated independently of each other. Testing showed that conventional biological treatment design parameters could be applied to fluidized bed treatment. These included food/mass ratio, solids retention time, and oxygen utilization. Very high biological organism concentrations could be maintained in the reactor. Treatment times were reduced so that 93% BOD removals were achieved in 16 minutes, 99% NH₃-N removals were produced in 11 minutes, and 99% NO₃-N removals were obtained in less than 6.5 minutes. Space requirements were less than 5% of what is necessary for conventional treatment; intermediary clarifiers were eliminated. Oxygen transfer is the major technological area being optimized. About 40 to 50 mg/liter of oxygen can be dissolved in waste water under atmospheric conditions at most operating temperatures. Recycling would be advantageous in completing treatment when the oxygen demand is high. Many methods of oxygen transfer were being investigated. Flow equalization, used during the pilot study, was a more favorable operating condition as compared to plants which do not employ constant flow. The system combines the best aspects of activated sludge and trickling filtration into one process. Costs should be less expensive than conventional treatment costs due to the space and time savings of the process. (Collins-FIRL) W77-09873

NATIONWIDE EVALUATION OF COMBINED SEWER OVERFLOWS AND URBAN STORM-WATER DISCHARGES. VOLUME II: COST ASSESSMENT AND IMPACTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. P. Heaney, W. C. Huber, M. A. Medina, Jr., M. P. Murphy, and S. J. Nix.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 005. Price codes: A17 in paper copy, A01 in microfiche. Report EPA-600/2-77-064, March 1977. 380 p, 62 fig, 73 tab, 109 ref.

Descriptors: *Combined sewers, *Overflow, *Storm water, Urban runoff, Pollution abatement, Treatment facilities, Costs, Model studies, Sewage treatment, *Waste water treatment, Economics.

Costs associated with various degrees of wet-weather pollution control were determined as part of a nationwide study. The quality and quantity of urban storm flow was assessed in nearly 248 American urban areas. Continuous simulation runs were used to determine pollution control levels for specified storage volumes and treatment rates in Atlanta, Denver, Minneapolis, San Francisco, and Washington, D.C. Equations derived from the collected data were combined into an optimization model that could determine the best mix of storage and treatment for any viable level of control in any city. Determinations suggested that annual costs would be about \$297 million for 25% pollution control and \$5,029 million for 85% control. Corresponding capital costs would be \$2,476 million and \$41,968 million. Potential savings were indicated if wet-weather quality control were integrated with dry-weather sewage treatment plants and/or storage facilities for storm water quality control. The use of best management practices (BMP) was suggested as an alternative means for reducing control costs. (Collins-FIRL) W77-09874

TWO-STAGE SETTLING IMPROVES SLUDGE REMOVAL EFFICIENCY,

Seelye, Stevenson, Value, and Knecht, New York.

C. R. Lee, L. T. Fan, M. C. Kuo, and T. Takamatsu.

Water and Sewage Works, Vol 124, No 5, p 41-44, May, 1977. 6 fig, 2 tab, 16 ref.

Descriptors: *Sedimentation, *Settling basins, *Design criteria, Suspended solids, Flow, Model studies, Separation techniques, Sludge, Performance, *Waste water treatment.

Flow patterns and geometric design have a great effect on sludge removal in sedimentation basins. A theoretical approach which divides basins into two or more stages was developed to improve removal efficiency. Modeling and simulation studies have indicated better performance in multi-stage settling tanks. Experiments were conducted to verify these results. One set of experiments was designed to identify axial dispersion from oscillating nets which generated different flow patterns and the second was to confirm performance of a two-stage tank. Results indicated that a two-stage settling tank was superior in performance, especially when axial dispersion was great. Every degree of dispersion was found to have an optimal first and second stage volume allocation. Well-designed weir troughs could improve overflow effluent quality from the first stage. Circular tanks could be used for both stages because weir loadings were smaller than those of rectangular tanks with similar capacities. Sludge spreading in single-stage rectangular settling tanks creates a long travel distance to the hopper in the sludge collector. This allowed a greater probability of sludge re-suspension in the tank. Long sludge residence times in the tank could create a septic or anaerobic state. In a two-stage tank, the first could be used as a thickener to produce fresher and denser sludge for recirculation and later dewatering. (Collins-FIRL) W77-09875

RADIATION TREATMENT OF SEWAGE SLUDGE—EXPERIENCE WITH AN OPERATING PILOT PLANT,

Bayerische Landesanstalt fuer Bodenkultur, Pflanzenbau und Pflanzenschutz, Munich (West Germany).

A. Suess, and T. Lessel.

Radiation Physics and Chemistry, Vol 9, No 1-3, p 353-370, 1977. 5 fig, 11 tab, 9 ref.

Descriptors: *Irradiation, *Pathogens, *Plant growth, *Treatment facilities, Temperature, Physical properties, Chemical properties, Design, Fuels, Economics, Equipment, Nutrients, *Waste water treatment, *Sludge treatment, *Pilot plants.

A 2 1/2-year pilot study was conducted to evaluate sludge treatment by irradiation. The West German plant was constructed with the irradiation area underground to minimize costs. Regulatory equipment, control instruments, and a laboratory were housed above ground. System economics, pathogenic destruction, effects on sedimentation properties, and effects of treated sludge on plants were evaluated. Several advantages were noted. Operation at temperatures of 25-30°C reduced component corrosion. No breakdown of organic nitrogen was induced and sludge volume was not increased. Good dewatering properties could reduce flocculation chemicals and decantation facilities. Plant energy requirements could be reduced and nuclear fuel cycle wastes could possibly be used. The process prevented weed seed germination and could be used to destroy parasites in fresh sludge. The simple design required no additional service staff. The prime disadvantage was the steady decay of the Cobalt 60 employed. Irradiation was found useful only if sludge was to be treated during the entire year and the plant capacity was greater than 50 cu m/day. A treatment of 210 minutes at 300 krad reduced enterobacteria by 3-4 log units. Total bacterial count and enterococci were reduced by 2 log units. Different composition was evident in the irradiated sludge; plant germination accelerated slightly after application of irradiated sludge, and yields were the same or slightly lower than control studies. Pasteurized sludge, however, showed a nitrogen loss, a decline in plant germination, and lower yields. Soil type and water capacity influenced sludge effects. Studies indicated that nutrients and minor elements of sewage sludge may be used by plants, and mineral fertilizer may be replaced. (Collins-FIRL) W77-09876

REDUCTION AND RECOVERY: KEYS TO ENERGY SELF-SUFFICIENCY,

Metcalf and Eddy, Inc., New York.

A. Jacobs.

Water and Sewage Works, Reference Issue, p 24-26, 28-30, 32-34, 37, April, 1977. 15 fig, 6 tab, 17 ref.

Descriptors: *Energy, *Fuels, *Electric power costs, Treatment facilities, Electrical power demand, Hydraulic machinery, Flow, Dewatering, Incineration, Heat, Gases, Sludge digestion, Polymers, Operation and maintenance, *Waste water treatment, Economics.

Energy self-sufficiency was discussed for waste water treatment facilities. The economic savings potential from reducing electrical energy demand is substantial, since energy costs are second in magnitude only to salary expenditures. Prime consideration was given to reduction of energy consumption and to recovery of waste heat and energy. Suggested steps included the reduction of peak demand loads; the use of energy efficient processes and equipment; improvement of plant control and operations; and preventive maintenance schedules. Proper selection of pumps, improvement of heat value of incineration products, and improved dewatering would provide savings. Flow equalization, reduction of sludge processing side streams, and minimized hydraulic losses were

considered for improving energy utilization in treatment processes. The use of sludge conditioners, such as organic polymers which do not reduce heat value, was suggested. Heat from incinerators could be used to preheat sludge and combustion air. Heat recovered from high temperature gases could provide an added energy source. Aerobic digester gas, and the liquid, gas, and solid residues of pyrolysis could be developed into fuel sources. Adopting any of these practices could reduce the requirements for outside power and fuel. (Collins-FIRL) W77-09877

POLYMER ADDITION IMPROVES WASTE WATER TREATMENT PROCESS,

Petrolite Corp., St. Louis, Mo. Tretolite Div.

R. J. Churchill, and R. L. Rybacki. Water and Sewage Works, Reference Issue, p 10-12, 14-17, 20, April, 1977. 8 fig, 2 tab, 5 ref.

Descriptors: *Polymers, *Water quality, Performance, *Treatment facilities, Sludge treatment, Biochemical oxygen demand, Suspended solids, Dewatering, Coagulation, Flocculation, Activated sludge, Filters, *Waste water treatment.

Polymers are added to waste water treatment processes to improve performance and effluent quality. They have been used to balance intermittent fluctuations of influent characteristics. Polymers function as the primary chemical conditioning agent or as an aid to the primary conditioner. They are commonly applied for sludge conditioning in elutriation, thickening, and dewatering; enhancement of alum coagulation/flocculation; and improvement of alum, ferric, or calcium precipitation of phosphorus in waste water. Their use does not create additional sludge and they may be reused at several points in the treatment system. Solids control can be obtained in primary and secondary clarification, and in activated sludge system bulking can be reduced. As a pretreatment additive, polymers can substantially decrease BOD load on the biological system through increased BOD and suspended solids removal. Polymer addition can increase the solids retention capacity of filters. Sludge settling rates and the underflow sludge concentration are also increased by polymer addition. Case studies were conducted to evaluate the benefits and limits of polymer addition. It was concluded that polymer addition could enhance treatment performance by smoothing temporary imbalances. It should not be considered the answer to all performance problems. (Collins-FIRL) W77-09878

CONCURRENT WASTE WATER RENOVATION AND SOLID WASTE COMPOSTING,

Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.

G. R. Lightsey, A. L. Hines, and R. W. Henderson.

Compost Science, Vol 18, No 2, p 14-16, March/April, 1977. 2 fig, 2 tab, 10 ref.

Descriptors: *Water reuse, *Waste disposal, Biochemical oxygen demand, Chemical oxygen demand, Heavy metals, Nitrogen, Ion exchange, Ultimate disposal, Phosphorus, Trickling filters, Waste water treatment.

Identifiers: *Composting (Solid wastes).

A study was conducted to determine the effectiveness of using bark in a trickling filter medium to reduce BOD and COD in waste water before its land disposal. Bark used in trickling filters for this purpose is converted into a useful nitrogen enriched compost. Raw bark and composted bark, minus nitrogen, were evaluated. A waste water with high BOD and COD concentrations, and one with heavy metal concentrations similar to that in municipal waste water, were tested. Raw bark achieved constant BOD removals of 60-70% and COD removals of 35-40%. Composted bark

produced much lower removal percentages. The small particle size of composted bark was the apparent reason for its poor performance. Composted bark absorbed more than 40% of heavy metal ions and raw bark removed nearly 13%. More than 75% of copper, cadmium and nickel was removed from the waste water by composted bark. Raw bark nitrogen concentrations increased from 0.28% to 0.9%. Trickling filters with raw bark media were judged to be potentially low cost means of pretreating waste water for land disposal. Further study should determine the optimum method for concurrent waste water pretreatment and conversion of solid wastes into useful compost. Maximizing the ion-exchange and adsorptive capacities of organic solid wastes by composting should also be investigated. (Collins-FIRL)

W77-09879

INACTIVATION BY IONIZING RADIATION OF SALMONELLA ENTERITIDIS SEROTYPE MONTEVIDEO GROWN IN COMPOSTED SEWAGE SLUDGE,
Sandia Labs., Albuquerque, N. Mex.
J. R. Brandon, W. D. Burge, and N. K. Enkiri.
Applied and Environmental Microbiology, Vol. 33, No. 4, p 1011-1012, April, 1977. 1 fig, 3 ref.

Descriptors: *Ionization, *Irradiation, *Pathogenic bacteria, *Salmonella, Sludge treatment, Disinfection, Waste water treatment, Economics, Performance, Evaluation.
Identifiers: *Composted sludge.

Ionizing radiation was evaluated as a polishing process to eliminate viruses, parasite ova, and pathogenic bacteria from composted sludge. *Salmonella enteritidis* ser. montevideo were inoculated into sterile composted sewage sludge to produce a count greater than 1,000,000,000/gram. A dosage rate of 15 krad/minute was used to irradiate the material to various levels. This material was then blended in physiological saline at a saline/sludge ratio of 4:1. The absorbed dosage needed per 90% reduction in population was found to be about 30 krad. The resistance of bacteria in the drier material, while expected to be greater, was about the same as that in liquid sludge treatments. This treatment should be very effective since a dose of 1 to 2 M rads would be used. (Collins-FIRL)

W77-09880

CHARACTER AND DEWATERING PROPERTIES OF SLUDGES FROM WATER TREATMENT,
Missouri Univ.-Columbia.
J. T. Novak.
AIChE Symposium Series, Vol. 73, No. 162, p 62-73, 1977. 15 fig, 3 tab, 13 ref.

Descriptors: *Dewatering, *Coagulation, *Filtration, Metals, Ions, Physical properties, Magnesium, Calcium, Sludge treatment disposal, Equipment, Treatment facilities, *Waste water treatment.
Identifiers: Specific resistance.

Sludges from various Missouri treatment plants were analyzed to determine their character and dewatering properties. Two types of sludges were found to be dominant - coagulant sludges and softening sludges. Sludge characteristics would determine the best process for improving dewaterability or reducing sludge volumes. The parameters used for sludge characterization were the rate of dewatering and the solids content of dewatered slurry. Dewaterability was determined by specific resistance measurements. Sludges containing substantial CaCO_3 filtered readily and those with no softening residues had greater resistances. Sludges from plants that combined softening and coagulation in a single basin filtered better than pure coagulant sludges. Increased magnesium content increased specific resistance slightly. Coagulant

metal cation levels greatly influenced specific resistance. Dewatering was found to depend upon the coagulant metal ion used, the calcium/magnesium ratio of the sludge, and the 'purity' of the coagulant in the sludge. Increased magnesium levels decrease the capacity for obtaining high solids concentration levels. No pattern was found for sludge compressibility data. Four dewatering processes were evaluated. These included sand bed draining, centrifugation gravity thickening, lagooning, and vacuum filtering. A handleable sludge was produced by vacuum filtering, but the other methods dewatered sludges to a highly viscous sludge that could not be handled by conventional earth moving equipment. The study parameters were quite adequate for the prediction of process performance. A final choice of dewatering method should depend upon the sludge type, landfill location, available land, and equipment. (Collins-FIRL)

W77-09881

LAND APPLICATION OF MUNICIPAL SLUDGE,
New Jersey Inst. of Tech., Newark.
For primary bibliographic entry see Field 5E.
W77-09882

PHOTODYNAMIC INACTIVATION OF INFECTIOUS AGENTS,
FMC Corp., Santa Clara, Calif. Environmental Engineering Lab.
M. F. Hobbs, C. P. Gerba, C. Wallis, J. L. Melnick, and J. S. Lennon.
Journal of the Environmental Engineering Division-ASCE, Vol. 103, No. EE3, p 459-472, June, 1977. 9 fig, 3 tab, 13 ref.

Descriptors: *Disinfection, *Irradiation, *Viruses, *Dyes, *Hydrogen ion concentration, Sewage effluents, Water purification, Equipment, Treatment facilities, Evaluation, Performance, Costs, *Waste water treatment.
Identifiers: Methylene blue.

Investigations were conducted to develop operating parameters and equipment for the disinfection of sewage effluents by continuous photodynamic inactivation. Tests were performed with clarified tap water and secondary sewage effluents which were inoculated with poliovirus. The parameters evaluated were a pH of 10 and methylene blue, a photoreactive dye. Technical grade methylene blue was added to produce a concentration of 1 to 5 mg/liter methylene blue. A plug flow cell and a flow-through cell operated in an upflow mode were used. Brief plug flow tests indicated effective photoinactivation in tap water at pH 10 with 5 mg/liter of methylene blue. Sewage effluent was treated with 2 mg/liter of methylene blue, at 22°C, with a 5 hour holding period. Results showed that treatment was effective, but the rate was about 50% of that achieved with clarified tap water. It was found that sewage effluents could be treated by high intensity lamps in direct contact with water to increase the inactivation rate. Inactivation rates were sensitive to heat and subsequent irradiation during sensitization. It was also proved that 1-2 mg/liter of dye was as effective as 5 mg/liter of dye. The increased rate and lower dye requirements could provide cost savings when considered as a unit process for waste water treatment. It was suggested that the process could easily be incorporated into physical-chemical treatment plants. It was also suggested for secondary treatment plants where tertiary treatment for nutrient and carbon removals was used. Water treatment plants using lime-softening would also benefit from this process. Chlorination and ozonation have lower capital costs. The facility's size would be about that of a tertiary plant for phosphorus and added carbon removal. (Collins-FIRL)

W77-09883

METHOD FOR THE DETERMINATION OF THE CONDITIONABILITY OF SEWAGE SLUDGE (ERARBEITUNG VON METHODEN ZUR ERMITTLUNG DER KONDITIONIERBARKEIT VON KLAERSCHLAEMMEN),
R. Leschber, and W. Niemitz.
Vom Wasser, Vol. 47, p 187-207, 1977. 9 fig, 3 tab, 10 ref.

Descriptors: *Sludge treatment, *Analytical techniques, Particle size, Flocculation, Capillary action, Filtration, Physical properties, Chemical properties, Dewatering, Municipal wastes, *Waste water treatment.

A method for the determination of sludge amenability to conditioning processes was developed. The method was based on measurement of capillary suction time (CST) of sludge after the addition of water and two standard flocculants, FeCl_3 and Praestol 444K, in three dosages. Measurement was made after addition and specified periods of stirring in a standard device. Specific resistance to filtration of sludge samples treated is measured at reduced atmospheric pressure. Standard dosages for treatment were 10, 5, and 2.5% FeCl_3 and 0.5, 0.25, and 0.125% praestol, as measured against the dry sludge residue. The resultant determinations are most useful in creating a more efficient sludge treatment process, especially for thickening and dewatering. (Collins-FIRL)

W77-09884

MIXER CUTS SOLIDS UP AND TIME DOWN FOR WASTE TREATMENT.
Process Engineering, p 79, March, 1977.

Descriptors: *Sewage effluents, *Mixing, *Aeration, Equipment, Industrial water, Domestic water, Solid wastes, Pumps, Pumping plants, Biochemical oxygen demand, Costs, *Waste water treatment.

A mixer-disintegrator has been developed which could be applied to the improvement of effluent treatment. One application involved comminution. Industrial and domestic effluent debris, such as rags, rubber, and plastics, could be reduced to particles small enough to be pumped with the effluent. Such a mixer was used in a South African pumping station to reduce reeds growing in a channel from a nearby dam to the pumping station outlet. The same device was used in England to improve the homogeneity of a sampling station's samples. It was also applied in the aeration process for BOD reduction. Air introduced into a disintegrating head at a low level in the liquid is finely homogenized and dispersed through the container. This increases air surface area and, presumably, oxygen transfer. Contact time is also increased. The strong action of the head prevents clogging with activated sludge or other solids. Oxygen transfer levels of up to 30% are possible with this mechanism. (Collins-FIRL)

W77-09885

NEW WASTEWATER TREATMENT SYSTEMS.
Modern Power and Engineering, Vol 71, No 3, p 34-35, March, 1977.

Descriptors: *Treatment facilities, *Filters, Pumps, Chlorination, Sludge treatment, Municipal wastes, Industrial wastes, Costs, Design, *Waste water treatment.

New waste water treatment systems are being developed for effluent pollution reduction. A plant using high rate direct filtration is now operating in Ontario and serves a population of 100,000 with expansion provisions for 165,000. The plant cost was \$15.8 million and expansion will add another \$12.7 million. A river intake pipe provides a 40 mgd inflow which passes through a filtration and collection system at 5 gpm/square foot. Two systems, a mixed media and a dual media filter system, are used for comparison of plant opera-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

tion and the development of information for future expansion. Six high-lift pumps with a 64 mgd capacity offset limited storage capacity. Elsewhere in Ontario, a 50 mgd filtration plant is being constructed with plant, reservoir and pumping station entirely underground. The cost of the \$20 million project was raised by \$1 million by the underground construction. Liquid chlorine will be used as disinfectant instead of chlorine gas. The system will utilize a 5,000 foot underground water intake pipe and sophisticated control devices. Future plans include remote operation of the plant from a filtration plant five miles away. A holding tank will allow treatment of backwash wastes and sludge will be discharged into sanitary sewers for treatment. Other innovative projects for industrial waste treatment and water recycling were surveyed. (Collins-FIRL)
W77-09886

A NEW RAPID DIGESTION PROCESS FOR SEWAGE SLUDGE UTILIZATION (EINNEUES SCHNELLROTTE-VERFAHREN ALS BEITRAG ZUR WEITERGEHENDEN KLAERSCHLAMM-VERWERTUNG).
P. Widmer, and H. G. Konstandt.
Gas-Wasser-Abwasser, Vol. 57, No. 3, p 297-303, March, 1977. 5 fig, 5 ref.

Descriptors: *Sludge digestion, *Sludge disposal, *Fertilizers, Pathogens, Nutrients, Safety, Odor, Sludge treatment, Nitrogen, Carbon, Temperature, *Waste water treatment.

A rapid sludge digestion process to prepare sludge for use in agricultural applications was described. Any such process should inactivate pathogenic and parasitic germs; preserve important plant nutrients, such as nitrogen and phosphorus; produce dry matter (less than 20% water) for storage purposes; and prevent unpleasant odors. The Fermenttechnik/Roediger quick-rotting process fulfills these requirements. The nitrogen/carbon ratio of the product was evaluated and a flow sheet of individual process phases was provided. Cost estimates were given for a plant which would serve a population of 13,500 people. (Collins-FIRL)
W77-09887

STUDY OF THE DECOMPOSITION OF ORGANIC MATTER BY THE RESPIROMETRIC DILUTION METHOD (UNTERSUCHUNGEN UEBER DAS ABBAUVERHALTEN ORGANISCHER STOFFE MIT HILFE DER RESPIROMETRISCHEN VERDUENNUNGSMETHODE).
R. Wagner.
Vom Wasser, Vol 47, p 241-265, 1977. 12 fig, 2 tab, 29 ref.

Descriptors: *Biodegradation, *Kinetics, *Organic matter, Analytical techniques, Domestic wastes, Nutrients, Evaluation, Chemical properties, *Sewage treatment, *Waste water treatment.

The decomposition of organic matter sewage was investigated with emphasis on biodegradation kinetics by the respirometric dilution method. This method used a nutritious matrix which contained great amounts of organic substances to compete as nutrients with the test substrate. A linear relationship was found between the reaction velocity constant logarithm and the time shift constant when adaptation by selection was not necessary. This indicated that biodegradation of individual compounds proceeded proportionately faster as degradation was delayed. A preferential sequence of chemical substances was found in the biodegradation of the nutrient matrix. Among tested substances, n-propanol was first and methanol was last in this sequence. Proper test substances would make possible quality checks for any nutrient matrix used in biodegradation studies. (Collins-FIRL)
W77-09888

PURIFICATION PLANT PROJECT,
ASEA Electric (Australia) Pty Ltd., Lilydale.
G. Bainbridge.
ASEA Journal, Vol 49, No 6, p 141-142, 1976. 5 fig.

Descriptors: *Treatment facilities, Water purification, Filtration, Pumping plants, Separation, Sedimentation, Aeration, Biological treatment, Electrical equipment, *Waste water treatment.
Identifiers: Melbourne(Australia).

The largest and most modern Australian sewage treatment plant, serving the Melbourne area, recently became operational. Its design capacity is 291,000 cubic meters/day and a similar-capacity second stage will be needed in the early 1980's. A 32-kilometer gravity main trunk sewer, interceptor sewers, a purification plant, and a 56-kilometer outfall compose the treatment system. Activated sludge purification processes are used at the purification plant. Effluent is filtered for large objects by mechanically cleaned screens; pumped to other similar screens for textile and similar waste material removal; and subjected to grit removal, pre-aeration, sedimentation, aeration, digestion, biological treatment, and secondary sedimentation. Supply and distribution of electrical energy are handled by a power distribution plant and low-voltage switchgear. Eight unit substations are provided for power reticulation, including 415 V equipment and 6.6 kV/415 V dry type power transformers and associated isolating switches. The plant's equipment is of a standardized design, supplied in modular form for construction to minimize future modifications or extensions. All portions of the facility were constructed to strict specifications. (Collins-FIRL)
W77-09889

ADVANCE SEWER PLANNING FOR RIO DE JANEIRO COASTLINE,
ENCIBRA South America, Rio de Janeiro (Brazil).
R. G. Ludwig, and S. A. S. Almeida.
Water and Sewage Works, Vol. 124, No. 4, p 70-72, April, 1977. 3 fig, 3 tab, 4 ref.

Descriptors: *Planning, *Sewers, *Treatment facilities, *Outfalls, Design criteria, Economics, Analysis, Waste disposal, Sewage treatment, Waste water treatment.
Identifiers: Rio de Janeiro(Brazil).

Rapid development along the Rio de Janeiro coastline created a need for a comprehensive sewage treatment plan. The 15,000 hectare area has 20 kilometers of beach front on the Atlantic Ocean and a network of lagoons. Variations in tides, ocean currents, density structure, and coliform disappearance rates were studied to evaluate ocean disposal alternatives. Water and sediment quality, as well as profiles and seabed soundings, were evaluated to assist predesign and cost estimations. Seasonal variation of ocean currents was a major area of concern. Lagoon disposal was considered, but the difficulty of controlling eutrophication by nutrient removal and of maintaining a high degree of effluent quality made this alternative doubtful. Comparison showed that ocean disposal after treatment was more feasible. Two sewerage schemes were proposed: concentration of regional sewage at a single disposal point, and independent systems at the eastern and western poles of the area. The second was more economical in sewer costs, but the necessary treatment facilities would be more costly; collection and single-site disposal seemed most effective. Proper diffuser design and dilution values of 150 to 1 can produce waste concentrations less than those required for protection of the ocean environment. This and a diffuser with small ports for field submergence, aided by water currents, can produce diffusion of wastes along an extended ocean area. Interim treatment, collection, and trunk sewer systems were proposed for areas which are developing more rapidly. (Collins-FIRL)
W77-09890

CHEMICAL TREATMENT OF SEWAGE,
Military Engineering Services, Chandigarh (India).
U. C. Thakur, S. M. Dhabadgaonkar, and W. M. Deshpande.
Indian Journal of Environmental Health, Vol. 19, No. 1, p 16-29, January, 1977. 10 fig, 1 tab, 14 ref.

Descriptors: *Water purification, Chemical oxygen demand, *Sewage treatment, Coagulation, Analysis, *Lime, Sludge, Treatment facilities, *Waste water treatment.
Identifiers: *Alum, *Chemical treatment(Sewage).

A report was presented on the reduction of raw sewage COD by alum, ferric chloride, ferrous sulfate, and lime. Chemical treatment is an important part of advanced treatment systems used to produce highly purified effluents. COD was chosen as the parameter for measurement of pollution strength reduction because the test sewage contained industrial wastes and refractory compounds with non-biodegradable substances. Samples were analyzed for pH, temperature, and alkalinity and a portion was fixed with sulfuric acid to measure raw sewage COD. All coagulants were added in dosages of 0, 30, 60 and 90 mg/liter, except lime which was added to increase pH to 11.0. Results indicated an optimum alum dosage of 60 mg/liter for COD removals of 52-62%. Ferric chloride and ferrous sulfate optimum dosages were 30 mg/liter for COD removals of 60-70%. It was found that COD reductions for the coagulants above COD reductions without coagulation were 25-35% for 30 mg/liter of ferric chloride and ferrous sulfate. There was no significant COD removal above '0' dosage for alum up to 30 mg/liter; increasing dosages from 60-90 mg/liter produced no substantial benefits. Observations indicated that, at all dosages, there was an increase in percentage removal of COD with increased raw sewage COD up to 700-800 mg/liter. Lime at pH 11 caused a 78-88% COD reduction in raw sewage. The addition of alum to lime treatment increased COD reduction by 4-5% and improved effluent clarity. Without coagulants, raw sewage COD reductions varied from 35-55%. Alum was considered most suitable when sludge volume production was a major consideration. The ratio of sludge volume was highest when lime coagulation was used. (Collins-FIRL)
W77-09892

WASTEWATER MICROBIOLOGY,
Texas A and M Univ., College Station. Dept. of Biology.
Annual Review of Microbiology, Vol. 30, p 263-277, 1976. 238 ref.

Descriptors: *Microbiology, *Microorganisms, *Yeasts, *Waste water treatment, Industrial wastes, Bacteria, Biochemical oxygen demand, Temperature, Nutrients, Nitrogen, Methane, Gases, Biological treatment, Chemical wastes, Pulp wastes, Algae, Anaerobic conditions, Aerobic treatment, Tertiary treatment, Treatment facilities, Water purification, *Reviews.

Microbiological aspects of waste water composition and treatment are reviewed. Taxonomic classification of bacteria and yeasts present in waste water remains problematic. Little is known about the effect of environmental conditions and mixed nutrients on substrate utilization, or about possible interactions among microorganisms. Considerable advances have been made in the use of microorganisms for reducing BOD and nitrogen content of waters. Microbial waste water treatment mineralizes organic matter, lowering BOD; removes minerals by removing cells growing on wastes; and inactivates pathogenic bacteria, yeasts, and viruses. In activated sludge treatment, it is believed that the zoogloea matrix or floc is produced by the bacterium *Zoogloea ramigera* Itz. There is also the possibility that the taxon does not exist or that the floc is produced by conventional bacteria. A zoogloea mass is desired since it settles out and allows discharge of clarified supernatant with

lowered BOD. Conventional bacteria are undesirable because they deter settling. High concentrations of flagellates reflect overloading of the system. Yeasts and molds are present, but play a minimal role in BOD reduction; however, fungi play a major role in the trickling filter. In addition, bacteria and algae are abundant in the trickling filter treatment. Algal growth in aerobic lagoons favors BOD removal during the day due to oxygen production, but inhibits BOD removal at night due to oxygen consumption. In anaerobic treatment systems, methane is produced from microbial activity and algae and photosynthetic bacteria are often present. The protozoa present are not useful in reducing BOD. Fungi and yeasts which may metabolize certain substrates are also in evidence. (Collins-FIRL)
W77-09893

EXPERIENCES WITH THE ORGANIC CARBON ANALYZER (TOC) BY MERZ FOR ROUTINE MONITORING AT THE BASF PURIFICATION PLANT (ERFAHRUNGEN MIT DEM TOC-SCHNELLESTIMMER NACH MERZ IN DER ROUTINEUEBERWACHUNG DER BASF).
For primary bibliographic entry see Field 5A.
W77-09894

EFFLUENT TREATMENT VERSUS DISPOSAL THROUGH LONG SEA OUTFALLS,
Watson (J. D. and D. M.), High Wycombe (England).
For primary bibliographic entry see Field 5E.
W77-09895

FERMENTATION TECHNOLOGY,
Pennsylvania Univ., Philadelphia. Coll. of Engineering and Applied Science.
A. E. Humphrey.
Chemical Engineering Progress, Vol. 73, No. 5, p 85-91, May, 1977. 15 fig, 18 ref.

Descriptors: *Fermentation, *Waste treatment, Sludge treatment, Activated sludge, Sedimentation, Physical properties, Anaerobic conditions, Biomass, Biochemical oxygen demand, Denitrification, Phosphates, *Waste water treatment, Gases, Foods, Energy.

The incorporation of fermentation into waste water treatment processes was considered among several applications of fermentation technology. These processes have been found to be important in the activated sludge treatment. Research during the development of the UNOX system showed that BOD could be controlled by the food/biomass ratio. It was noted that a sludge with much better settling characteristics could be produced. Waste water denitrification could be achieved with a one-pass system rather than the usual two-step system. Placing the anaerobic stage first, followed by an aerobic treatment, produced a high internal recycle system that required no carbonaceous energy source. Influent BOD drove the reaction and the process had a lower oxygen demand than a conventional activated sludge system. A system which involved the removal of phosphate in a polymeric form such as polymetaphosphate was recently investigated. It was shown that this form could perform as a phosphagen analogous to the energy transfer compound, creatine phosphate. The perfection of this system could avoid the banning of phosphate detergents. The production of methane gas was investigated as an energy source. Fermentation as a means of generating food and feed from raw material sources was also studied. (Collins-FIRL)
W77-09896

IDENTIFICATION OF THE VIRUCIDAL AGENT IN WASTE WATER SLUDGE,
Sandia Labs., Albuquerque, N. Mex.
For primary bibliographic entry see Field 5A.
W77-09897

LACEY, OLYMPIA, TUMWATER, AND THURSTON COUNTY WASTEWATER TREATMENT.
A. L. Kimbel.
Consulting Engineer, Vol. 48, No. 5, p 79, May, 1977.

Descriptors: *Treatment facilities, *Sewers, Water purification, Infiltration, Organic matter, Water quality control, Storm water, Costs, Flow, Planning, Water resources development, *Waste water treatment.

A study was conducted to develop cost effective waste water collection, treatment, and disposal processes for a complex treatment facility in Olympia, Washington. The objective was to upgrade receiving water to a state fit for water recreation and shellfish harvesting. The study had to provide a treatment program for a combined population of 50,000 and a brewery which produced major organic discharges. Water quality analysis, planning criteria development, environmental evaluation, treatment and disposal alternatives, and institutional and financial considerations were involved. The poor quality of the receiving waters was due to primary treatment, insufficient system capacity, and high inflow-infiltration in the collection system. This resulted in frequent and substantial overflows of untreated storm water and raw sewage mixtures into the inlet. Final recommendation was for a unified, upgraded, and enlarged treatment facility at the present primary treatment plant. This facility, with an improved and repaired collection system, would be sufficient. Equalization basins would store peak storm flow from all sources. Pure oxygen and ozone would be used to decompose organics and destroy bacteria and viruses. This plan would reduce treatment scale and plant site size, while eliminating the costs and problems of chlorine usage. (Collins-FIRL)
W77-09898

MICROFLOTATION IN EFFLUENT PURIFICATION (MIKROFLOTATION IN DER ABWASSERAUFBEREITUNG),
B. Dobias.
Vom Wasser, Vol 47, p 210-217, 1977. 4 fig, 1 tab, 20 ref.

Descriptors: *Flotation, *Water purification, Separation techniques, Suspended solids, Particle size, Treatment facilities, Urban areas, Municipal wastes, *Waste water treatment.
Identifiers: Stockholm (Sweden), *Microflotation (Waste water).

The theory and technology of microflotation in waste water treatment were reviewed. The foam separation method was found to remove finely dispersed particles from water or aqueous solutions. A summary of Stockholm's utilization of the flotation cell for waste water treatment was presented. (Collins-FIRL)
W77-09899

THE HANDLING OF NITROGENOUS WASTES IN RURAL INDIA,
Andhra Univ., Waltair (India). Dept. of Environmental Engineering.
T. S. Rao.
Ambio, Vol 6, No 2-3, p 134-136, 1977. 1 fig, 1 tab, 13 ref.

Descriptors: *Nitrogen compounds, *Oxidation lagoons, *Water tables, *Waste disposal, Sewers, Drainage, Nutrients, Fertilizers, Methane, Gases, Soil types, *Waste water treatment, Rural areas.
Identifiers: *India.

The disposal of nitrogenous wastes in rural India was discussed. Human, agricultural, and animal wastes can be recycled so that their nitrogenous contents may be applied for useful purposes. Domestic human waste disposal systems were

proposed depending upon depth of ground water tables. High groundwater areas allow the use of flushing toilets and public latrines. Wastes can be transported to oxidation lagoons via sewers and lined, open surface drains. Stabilized effluent may be discharged to waterways, used to recharge groundwater, or to fertilize crops. Treated effluent may also be pumped to a reservoir to provide nutrients for algal growth and increased fish production. Areas with low water tables could utilize less expensive disposal alternatives such as bore-hole latrines with or without water seal, pit-latrine, or leaching cesspools with earthen rings or bamboo-matting for lining. Aqua privies with reverse filters, septic tanks with soakage pits, or dispersion trenches could be used in hard and rocky areas with low water tables. The latter could be used in community bio-gas plants to produce methane gas for cooking and lighting. The sludge from this method has a high nitrogen content and could be used for composting. In sandy soils, latrines and cesspools must be well above the water table to avoid contamination. Drainage well above flood level was suggested. Costs for treatment plants were estimated to be about five times greater than that of oxidation ponds. (Collins-FIRL)
W77-09900

EFFECT OF SORBED ORGANICS ON THE EFFICIENCY OF AMMONIA REMOVAL BY CHLORAMINE-CARBON SURFACE REACTIONS,
Westvaco Corp., North Charleston, S. C. Charleston Research Center.
A. B. Scaramelli, and F. A. DiGiano.
Journal Water Pollution Control Federation, Vol 49, No 4, p 693-705, April, 1977. 14 fig, 4 tab, 15 ref.

Descriptors: *Chemical reactions, *Organic matter, *Activated carbon, *Ammonia, Kinetics, Separation techniques, Adsorption, Nitrogen, Organic compounds, *Waste water treatment, Design, Hydrogen ion concentration.

There are several limitations in existing physical-chemical methods for removing ammonia from waste water. A process was developed to remove nitrogen which used chlorination followed by activated carbon contact. The stoichiometry and kinetics of mono- and dichloramine-carbon reactions were investigated to optimize the process design of this removal method. The interaction of organic adsorption and chloramine-carbon reactions was also studied. Chlorine and ammonia were mixed and the chloramine-containing solution was passed upward through a carbon column. The rate of the monochloramine-carbon reaction was of the first order. The rate decreased with increased reactor operating time up to 140 hours. Methylene blue and alum-clarified waste water reduced the mono-chloramine rate constant to lower steady-state values. Alkylbenzenesulfonate produced a lesser rate reduction. There was no reduction with dinitrophenol. Organics also reduced the rate of nitrogen gas production. The presence of monochloramine in the column influent reduced the organic adsorption capacity of the carbon. Both mono- and dichloramine were converted to nitrogen gas by surface reactions. Dichloramine showed a near 100% conversion to nitrogen gas. Decreases in conversion with continued operation suggested carbon surface poisoning due to surface oxide buildup. Pore diffusion rather than surface reaction controlled the dichloramine conversion rate. Several process alternatives were suggested for handling the problematic elements of this method. (Collins-FIRL)
W77-09902

COMPUTER APPLICATION IN WATER AND WASTE WATER MANAGEMENT: A PANEL DISCUSSION,
Houston Univ., Tex. Dept. of Civil Engineering.
J. F. Andrews, J. Radziul, H. D. Gilman, H. D. Gilman, and H. J. Graesser.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

American Water Works Association Journal, Vol 69, No 5, p 246-255, May, 1977. 4 fig.

Descriptors: *Water management, *Automatic control, *Computers, Design, *Automation, *Waste water treatment, Personnel, Operations, *Treatment facilities, Water quality control, Economics.

A panel discussion was conducted on the application of computers in water and waste water management. The participants represented groups responsible for design engineering, installation, and computer use. Facilities in Philadelphia, Pennsylvania, and in Dallas, Texas, were described as examples of the usefulness of computers. The justifications for computer usage were the improvement of effluent water quality to meet new standards, the facilitation of data collection and subsequent evaluation of treatment processes, and cost savings. The use of automated pumping could produce a \$1420/month savings in one Philadelphia district. Experience in Dallas suggested that development of computer operations should be progressive, well-planned, and held within reasonable expectations of performance. An operations system was suggested, as well as an information system at the management level. Feasibility studies should be conducted prior to the implementation of a computer program. In evaluating automated systems, it should be noted that the cost of software is rising, while hardware costs have been falling about 30% each year. Both remote and in-plant instrumentation are considered necessary, and more reliable sensors must be developed. (Collins-FIRL)
W77-09903

AERATION: PROPER SIZING IS CRITICAL., Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. J. H. Sherrard. Water and Wastes Engineering, Vol. 14, No. 4, p 62, 66-67, 71, April, 1977. 4 fig, 4 tab, 6 ref.

Descriptors: *Aeration, *Treatment facilities, *Design, Performance, Activated sludge, Mechanical equipment, Oxygen, Temperature, Microorganisms, Operations, Biochemical oxygen demand, Nitrogen, Nitrification, *Waste water treatment. Identifiers: Mechanical aerators.

The selection of low speed mechanical aerators was considered. Any aeration method must produce enough mixing to maintain activated sludge floc in suspension and supply sufficient oxygen transfer to meet the demands of microbial growth. Equations were provided to help judge a given aerator's performance. Mechanical aerators must meet two standards: power, and sufficient oxygen for microbial metabolism. The first depends upon the type of aerator and the geometry of the basin. The latter involves oxygen for organic removal and nitrification, and depends on plant operation and the $BOD_5/(org-N + NH_4^+ - N)$ ratio. Biokinetic coefficients should be established to make quality and oxygen needs predictable as a function of treatment process operating conditions. Several examples of typical solutions were presented. It was concluded that the use of a ratio of 1 mg/liter of oxygen to 1 mg/liter of BOD_5 could be misleading and result in a faulty selection. Nitrogenous oxygen demand from nitrification should be used for aerator selection if higher mean cell residence time values are used. Oxygen transfer requirements can be met in some instances by lowering process mean cell residence time to decrease oxygen needs. (Collins-FIRL)
W77-09905

ANALYSIS OF ECONOMIC SEWAGE LIFT STATION DESIGN. Stanley Associates Engineering, Ltd., Edmonton (Alberta). For primary bibliographic entry see Field 8C.
W77-09906

CHANGES IN INORGANIC NITROGENOUS COMPOUNDS FROM SEPTIC TANK EFFLUENT IN A SOIL WITH A FLUCTUATING WATER TABLE. Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy. For primary bibliographic entry see Field 5B.
W77-09907

ZETA POTENTIAL MEASUREMENT. For primary bibliographic entry see Field 5A.
W77-09908

ATOMIC ABSORPTION IN WATER AND WASTE WATER ANALYSIS. Perkin-Elmer Corp., Lombard, Ill. For primary bibliographic entry see Field 5A.
W77-09909

GRAVITY THICKENING OF WATER-TREATMENT-PLANT SLUDGES. Dorr-Oliver, Inc., Stamford, Conn. P. Kos. American Water Works Association Journal, Vol. 69, No. 5, p 272-282, May, 1977. 10 fig, 30 ref, 2 append.

Descriptors: *Sludge treatment, *Model studies, *Flocculation, Pressure, Physical properties, Suspended solids, Loads (Forces), Treatment facilities, Performance, Design, Evaluation, *Waste water treatment. Identifiers: *Gravity thickening, Water treatment wastes.

Conclusions from previous studies of gravity thickening prefaced this report of a study on sludge behavior during steady-state continuous thickening. Steady state conditions were established, and contraction and pressure distribution measurements were made relative to thickening zone depth. Equations were developed to analyze solids-handling capacity and the movement of planes of constant concentration in the thickening of nonflocculant suspensions. The major difference between these and flocculant suspensions is that larger concentrations of the latter occur in channeling and compression processes which do not occur in nonflocculant suspensions. The developed channeling and compression study methods were too simple for the complete description of continuous gravity thickening. A model of flocculant porous medium was constructed to describe water treatment plant sludges during gravity thickening. The mathematical description of flocculant porous medium was based on intrinsic conductivity, or the filtration characteristic of sludge, and the modulus of linear compressibility, which is its consolidation characteristic. Equations for determining the effective pressure changes with time were used to describe the batch and unsteady continuous thickening processes. The coefficient of linear compressibility was revealed to be a function of the suspended solids concentration. Filtration characteristics were dependent upon flocculant porous medium flow conditions, in addition to being concentration dependent. Channeling was described as a non-Darcian flow. A computer simulation of steady-state continuous gravity thickening was used to establish design parameters. (Collins-FIRL)
W77-09912

BOD5 REMOVAL FROM AERATED LAGOON SYSTEMS. Clemson Univ., S. C. Dept. of Environmental Systems Engineering. L. G. Rich, and S. C. White. Water and Sewage Works, Reference Issue, p 21-23, April, 1977. 6 fig, 7 ref.

Descriptors: *Oxidation lagoons, *Biochemical oxygen demand, Suspended solids, *Aeration, Dissolved oxygen, Treatment facilities, Algae,

Model studies, Flow rates, Hydraulic properties, *Waste water treatment, *Aerated lagoons. Identifiers: *BOD removal.

Design and operation criteria were suggested for BOD removal in aerated lagoon systems. A four-cell, dual-power system could achieve effluent quality with a lower retention time than a two-cell, dual-power level system. Lagoons presently used are of two types. Completely suspended lagoons maintain all settleable solids in suspension. Partially suspended systems hold only a portion of settleable solids in suspension. Power levels depend upon lagoon geometry and size, as well as the type of aerator involved. A completely suspended cell followed by a partially suspended cell uses less lagoon volume to attain a desired soluble BOD_5 effluent concentration than either type used individually. Various equations were used to determine total retention times for both systems. An infinite retention time was calculated for both systems, but the four-cell system produced shorter retention times. This system would not produce any significant algal growth with retention times under 2 or 3 days. Algal growth at any retention time would be greatly reduced by the system. It was found that the system showed greatest enhancement when the cell number was increased from one to three. Multicellular construction resulted in much smaller cells. Flow variations could create some system instability. The dynamic behavior of the two systems was studied, at various flows, with the aid of a modeling program. The four-cell system was slightly more sensitive to flow variations, but recovery time could be twice as long. This system's surface-overflow rate in the last cell would help to maintain a stability in its effluent suspended solids. Results of the model study and laboratory studies produced several design criteria which related settling characteristics of biomass solids, hydraulic retention times, and flow rates to BOD removal. (Collins-FIRL)
W77-09913

THE IDENTIFICATION AND ADAPTIVE PREDICTION OF URBAN SEWER FLOWS. Cambridge Univ. (England). Dept. of Engineering. For primary bibliographic entry see Field 5B.
W77-09914

REMOVAL OF NUTRIENTS FROM TREATED MUNICIPAL WASTE WATER BY WETLAND VEGETATION. Water and Wastewater Technical School, Neosho, Mo. F. L. Boyt, S. E. Bayley, and J. Zoltek, Jr. Journal Water Pollution Control Federation, Vol. 49, No. 5, p 789-799, May, 1977. 9 fig, 7 tab, 17 ref, 2 append.

Descriptors: *Nutrients, *Municipal wastes, *Filtration, *Vegetation, *Wetlands, Water quality, Bacteria, Sediments, Hydrologic aspects, Economics, Waste disposal, *Waste water treatment.

A study was conducted, in Florida, to determine the ability of wetland vegetation to remove nutrients from treated municipal waste water. Effluent from a 0.25 mgd secondary treatment trickling filter plant was discharged into a mixed hardwood swamp. Poor plant operation has produced only primarily treated effluent for the past few years. The study involved monthly water chemistry sampling, coliform and fecal streptococci sampling, sediment analysis, and recording of tree growth data. Hydrologic data were used to develop a nutrient budget. Study results revealed 98.1% total phosphorus reductions and 89.5% total nitrogen reductions. Heavy metal concentrations were low due to the absence of industrial wastes; the amounts of lead were 0.03 mg/liter, and of copper, 0.02 mg/liter. Dissolved oxygen in the experimental swamp averaged 2.8 mg/liter in a range of 0.3-6.3 mg/liter. The control swamp averaged

2.4 mg/liter in a range of 2.0-4.0 mg/liter. Sediments were normally anoxic. Anoxic conditions were best for nutrient uptake by plants. The sediment nutrient levels were similar in both experimental and control swamps. A layer of clay in the sediment prevented exchange between waste water-containing surface water and groundwater. The dominant soil allowed little filtration, and groundwater recharge was slight. The fecal coliform count in the control area was 200 per 100 millimeters, which was above national potable and recreational water standards. The fecal coliform/fecal streptococci ratio was less than 1, suggesting that high fecal bacterial counts were of livestock origin. Human fecal bacteria were removed in the wetlands after the effluent travelled less than a mile. Tree growth indicated quicker nutrient uptake in the experimental area. It was concluded that the wetland system could be substituted for tertiary treatment and save area residents the \$79,500/year costs for a new treatment facility. (Collins-FIRL)

W77-09916

OPTIONS FOR SLUDGE-TO LAND, SEA OR FIRE,
For primary bibliographic entry see Field 5E.
W77-09918

SOUTH BEND'S INDUSTRIAL SURVEILLANCE WASTE WATER MONITORING PROGRAM,
South Bend Bureau of Wastewater, Ind.
For primary bibliographic entry see Field 5A.
W77-09919

CONSTRUCTION MANAGEMENT FOR WASTE WATERTREATMENT PLANTS,
CM Associates, Inc., Houston, Tex.
W. Strang.
Public Works, Vol 108, No 5, p 82-84, May, 1977. 2 fig.

Descriptors: *Construction, *Treatment facilities, *Management, Decision making, Personnel, Structural engineering, Design, Equipment, Contract administration, Costs.
Identifiers: Construction management.

The construction management approach was applied to waste water treatment facilities. This approach was found to alleviate several problems of past decision making processes. Problems such as selecting designers and subcontractors, procuring equipment, and funding cost overruns, can be more efficiently handled. Under this management process, a construction manager and designer are hired at about the same time. The manager does cost estimation, cost consulting, and scheduling in the early stages. He provides contract management, field supervision, and scheduling during construction. Fast-tracking may then be used for permit bidding and for some construction. Fast-tracking are completely designed. This considerable reduces construction time. The approach facilitates communication between users and subcontractors. Cost reductions can be achieved through bid selection by the owner rather by a general contractor. Direct negotiations between the manager and the lowest bidder may result in additional savings. General managers, who would include allowances for contingencies in their bids, are avoided. The owner, however, accepts the responsibility for risks. There is also the liability of extending funds, as a result of fast-tracking, before a final cost is known. Construction management has so far been applied mainly for schools and health facilities. While general contractors or designers may be hired as construction managers, there are some organizations which will provide this management as their sole function. (Collins-FIRL)

W77-09920

IMPACT OF MUNICIPAL WATER AND SEWAGE CHARGES ON INDUSTRY,
Packard and Anderson Engineers, Auburn, N. Y.
For primary bibliographic entry see Field 5G.
W77-09921

CROSS CANADA REPORT,
For primary bibliographic entry see Field 5G.
W77-09923

SYNTHETIC AGGREGATES MADE FROM SEWAGE PLANT SLUDGE.
For primary bibliographic entry see Field 8F.
W77-09924

COLORADO RIVER BASIN SALINITY CONTROL PROJECT—TITLE I,
Bureau of Reclamation, Yuma, Ariz. Yuma Projects Office.
J. F. Rhinehart.
Arizona Water Resources Project Information, Project Bulletin No 16, May 1977. 4 p, 4 fig.

Descriptors: *Saline water, *Water quality control, *Colorado River Basin, *Arizona, *Desalination, Mexican water treaty, Treaties, Drainage water, Canals, Concrete-lined canals, Water resources development, Water management (Applied), Groundwater resources, Pumping, Electrodialysis, Reverse osmosis, Irrigation effects, Irrigation efficiency.

Background and general information are presented on Title I of the Colorado River Basin Salinity Control which involves three major projects, the central one being construction of a 100 million gallon-per-day desalting plant at Yuma, Arizona. The problems of water quality have been especially acute for Mexico, which has received water of increasing salinity in diverting procedures allowed by a 1944 treaty with the United States. The reasons for increased salt concentration are explained, along with remedies provided in treaty agreements since 1965. Title I of the Colorado River Basin Salinity Control Act authorized a desalting complex to reduce salinity of the Wellton-Mohawk drainage, a new concrete-lined canal or lining of the existing canal to replace the first 49 miles of the Coachella Canal, and a protective and regulatory groundwater pumping program for the South Yuma Mesa and southwestern Yuma Valley. The proposed desalting plant will be the largest in the world, with membrane type desalting units (either a reverse osmosis or electrodialysis process) used. Plant design and uses are discussed, along with preliminary tests to determine ways of increasing irrigation efficiency. The groundwater pumping program will produce a yearly net water savings of about 125,000 acre-feet, while the desalting complex will salvage 123,000 acre-feet. (Jahns-Arizona)

W77-09931

LIMNOLOGICAL INVESTIGATION OF THE MUSKEGON COUNTY, MICHIGAN, WASTE-WATER STORAGE LAGOONS. PHASE 1,
Western Michigan Univ., Kalamazoo. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-10061

TACONITE TAILINGS DISPOSAL, RESERVE MINING COMPANY, SILVER BAY, MINNESOTA.
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 5C.
W77-10062

MAKING SURE OF PIPELINE PERFORMANCE,
For primary bibliographic entry see Field 8A.
W77-10068

SEWER-MAINTENANCE PRACTICE AND EQUIPMENT,
Durban City Engineers Dept. (South Africa).
For primary bibliographic entry see Field 8G.
W77-10078

CLARIFIER FOR UNDERGROUND USE,
W. E. Schlitter.
S.A. Mining and Engineering Journal, Vol. 89, No. 116, p 70-71, May 1976. diagr.

Descriptors: *Underground structures, Suspended solids, *Flocculation, Lamellae, Sedimentation rates, Mine water, Uniform flow, *Waste water treatment, *Treatment facilities, Africa.
Identifiers: South Africa.

The design, construction and operation of a clarifier for underground use is described. The use of flocculants and the insertion of inclined lamella plates to increase the settling velocity and thus the efficiency of the clarifier is advocated. Relative directions of plate inclination and water flow, i.e. countercurrent, uni-directional and cross-flow are discussed. (So African Water Info Center)

W77-10081

CONTROLLING THE ACCESS OF NUTRIENTS FROM POINT AND DIFFUSED SOURCES WITH SPECIAL REFERENCE TO THE PRETORIA/WITWATERSRAND/VEREENIGING REGION,
Johannesburg City Council (South Africa).
For primary bibliographic entry see Field 5G.
W77-10082

THE ACTIVATED SLUDGE PROCESS, PART 1 - STEADY STATE BEHAVIOUR,
Cape Town Univ. (South Africa). Dept. of Water Resources and Public Health Engineering.
G. V. Marais, and G. A. Ekama.
Water SA, Vol. 2, No. 4, p 164-200, October 1976. 29 fig, 3 tab, 33 ref.

Descriptors: *Waste water treatment, *Activated sludge, Oxygen demand, Nitrification, Metabolism, Design criteria, Kinetics, Temperature effect, Aerobic digestion, Mixing, Nutrient requirements, Nitrogen, Suspended solids, Chemical oxygen demand.
Identifiers: South Africa.

The activated sludge process theory is comprehensively investigated at steady state in terms of the sludge age. Equations are presented for calculating the masses of active, endogenous residue and inert volatile material in the reactor. These are integrated with the oxygen demand. Nitrification kinetics investigation indicates that the rate limiting step in municipal wastewaters is the conversion of organic TKN to the NH₄-form. A procedure for design in terms of sludge age is set out. (So African Water Info Center)

W77-10094

5E. Ultimate Disposal Of Wastes

SOIL TEMPERATURES AND HEAT LOSS FOR A HOT PIPE NETWORK BURIED IN IRRIGATED SOIL,
Energy Resources Co., Cambridge, Mass.
For primary bibliographic entry see Field 5D.
W77-09654

DILUTION CHARACTERISTICS OF EFFLUENTS IN DEEP WATER RESERVOIRS DETERMINED WITH A RADIOACTIVE INDICATOR (ON THE EXAMPLE OF LAKE BAIKAL), (IN RUSSIAN),
For primary bibliographic entry see Field 5B.
W77-09735

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

JET-FLAME SAVES SLUDGE DISPOSAL COST WITH DEODORIZING EFFECT.
Tokyo Univ. (Japan). Dept. of Mineral Development and Engineering.
Z. Hokao.
Japan Pulp and Paper, Vol. 14, No. 3, p 37-43, September, 1976. 11 fig, 1 tab.

Descriptors: *Pulp wastes, *Sludge treatment, *Dewatering, *Odor, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Sludge, Costs, *Sludge disposal, *Incineration.

The jet-flame process for dewatering and deodorizing paper mill effluent sludge is described. In the process, sludge is exposed to a jet flame having a temperature of 1,800-2,000 K and a velocity of 1,200 m/sec. Special features and benefits of the process are outlined. Jet-flame treatment costs less than incineration. A description is given of the jet burner, and pilot plant trials and experimental results are discussed. Some possible uses of the sludge residue are indicated. (Witt-IPC)
W77-09737

A REPORT ON STUDIES OF THE EFFECTS OF DREDGING AND DISPOSAL IN THE GREAT LAKES WITH EMPHASIS ON CANADIAN WATERS.
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W77-09794

SPRAY IRRIGATION-WASTE WATER TREATMENT FACILITY. NORTH BRANCH FIRE DISTRICT NO. 1, WEST DOVER, VERMONT.
For primary bibliographic entry see Field 5D.
W77-09828

CONTINUOUS COMPOSTING OF ORGANIC WASTE-WASTE-BY AUTOMATIC CONTROL OF FERMENTATION TEMPERATURE AND HUMIDITY OF PRODUCT AND CONTROL OF CARBON DIOXIDE OR OXYGEN IN WASTE GASES.
F. X. Kneer.
Netherlands Patent NL 7604-357. Issued March 17, 1977. Derwent Netherlands Patents Abstracts, Vol. Y, No. 13, p D1, May, 1977.

Descriptors: *Patents, *Sludge disposal, Organic matter, Automatic control, Fermentation, Temperature, Humidity, Carbon dioxide, Oxygen, Equipment, Aeration, Microorganisms, *Waste water treatment, Ultimate disposal, *Waste disposal.
Identifiers: *Composting.

A patent was issued for a continuous composting process for organic waste water sludge. Major features of the system are automatic control of fermentation temperature, product humidity, and carbon dioxide or oxygen in the waste gases. The waste/sludge flows down through a closed aeration reactor. Reactor readings determine the amount of air contracted with the waste stream. The air bubbles flow upward through the waste. Quantity and flow rate are controlled based on comparisons of the pre-set and real values of CO₂ and O₂ in the waste air. Water is supplied as a function of humidity measurements made in the upper and lower third of the waste stream. Air heated to 30-50°C is supplied to the base of the waste. The process operates for long periods under optimum conditions and a minimum of labor. The compost contains a high degree of biologically active microorganisms and is free of pathogenic organisms and weed seeds. (Collins-FIRL)
W77-09831

GO AHEAD FOR LONG SEA OUTFALL.
For primary bibliographic entry see Field 5D.

W77-09836

CHELLASTON TRUNK FOUL SEWER. SOME INTERESTING ASPECTS OF THE SCHEME.
Derby Borough Council (England) Drainage Section.
For primary bibliographic entry see Field 5D.
W77-09837

CO-BURNING OF SLUDGE AND REFUSE WITH WASTE HEAT RECOVERY.
Cosulich (William F.) Associates, Woodbury, N. Y.
W. F. Cosulich.
Public Works, Vol. 108, No. 5, p 76-79, May, 1977. 2 fig.

Descriptors: *Incineration, *Waste disposal, *Sludge disposal, Equipment, Design, Costs, Temperature, Treatment facilities, Ultimate disposal, Cooling water, Steam, Electric power, Waste water treatment.

The co-burning of sludge and refuse is being developed by Glen Cove, N.Y., because of an EPA ban on ocean disposal and a New Jersey ban on out-of-state refuse dumping. Heat from the incineration process will be used to produce steam and electrical power for the waste water treatment plant and the incinerator. The facilities will consist of an 8 mgd activated sludge nitrification plant and a 200 ton/day incinerator. Four different incineration systems were considered: pyrolysis, multi-hearth, fluidized bed, and stoker fired. Pyrolysis was judged to be uneconomical for the community, and developmental multi-hearth incinerators showed no economic advantage over stoker fired incinerators. Fluidized bed incinerators were also in developmental stages and there was, again, no economic advantage. The stoker fired incinerator was recommended after examination of a plant in Norwalk, Connecticut. A mixture of 87% refuse and 13% sludge, by weight, provided excellent combustion efficiency. The system's major aspects include the method of feeding sludge to the furnace, the stoker, and the control system for combustion air. Sludge, fed into the furnace as a thin layer on top of refuse dries and burns during the 30 minute furnace residence time. The stoker should not have large openings but should provide a gentle agitation. Controlled temperatures minimize slagging on the refractory walls and are essential for steam and electricity production. The chosen system uses two 100 ton/day furnaces with double reciprocating stokes and a modulating air system. The high heat value of the refuse-sludge mix was estimated at 4,120 Btu/pound. This is expected to produce 34,000 pounds/hour of steam which will power a 2.2 megawatt multi-stage condensing turbine generator set. Air pollution controls are to be included and settled sewage or treated effluent could serve as condenser cooling water. Three 1,000 KW diesel generators will provide standby power. (Collins-FIRL)
W77-09857

VIRUS AND BACTERIA REMOVAL FROM WASTE WATER BY RAPID INFILTRATION THROUGH SOIL.
Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
For primary bibliographic entry see Field 5D.
W77-09860

PASTEUR V CURIE.
For primary bibliographic entry see Field 5D.
W77-09864

GROWTH OF TULIPS TREATED WITH SLUDGE CONTAINING DEWATERING CHEMICALS.
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
M. B. Kirkham.

Environmental Pollution, Vol 13, No 1, p 11-20, May, 1977. 1 fig, 4 tab, 31 ref.

Descriptors: *Plant growth, Chemicals, *Sludge disposal, *Waste disposal, Sludge treatment, Dewatering, Chlorides, Lime, Chemical treatment, *Waste water treatment.
Identifiers: Tulips.

A greenhouse study was conducted to determine the effect of a ferric chloride-lime treated, dewatered sludge on tulip growth. Comparisons were made on the growth of plants receiving dried organic sludge, liquid organic sludge, primary effluent, and tap water. No additional chemicals were added to either of the organic sludges. Results revealed that tulips grown in chemical sludge had an average height shorter than that of the other tulips, with no buds or flowers. Liquid organic sludge, tap water, and primary effluent produced plants which flowered in 46 days. Dry organic sludge produced plants of a height intermediate to that of the others; these tulips had buds but no blooms. Growth was better with liquid organic sludge than with dry organic sludge. This suggested that more sludge could be applied to soil surfaces than could be mixed with or injected into the soil. The chemical sludge-treated soil produced highest soil nitrogen levels; phosphorus levels were medium to high in all soils. Extractable concentrations of trace elements and phosphorus were lower in soils treated with chemical sludge than those treated with dried or liquid organic sludge. Calcium was highest in soil treated with chemical sludge. Lime, in acidic soils, aids plant uptake of phosphorus; an excess of lime decreases available boron, iron, potassium, manganese, phosphorus and zinc. Ferric chloride in chemical sludge did not appear to be soluble. It was concluded that conditioned sludge containing ferric chloride and lime could not be used to grow tulips. (Collins-FIRL)
W77-09867

ELEMENTAL COMPOSITION OF SLUDGE-FERTILIZED CHRYSANTHEMUMS.
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
M. B. Kirkham.
Journal of the American Society for Horticultural Science, Vol 102, No 3, p 352-354, May, 1977. 2 tab, 14 ref.

Descriptors: *Plant growth, *Fertilizers, *Sludge, Nitrogen, Potassium, Phosphorus, Nutrients, Trace elements, Toxicity, Hydrogen ion concentration, *Waste water treatment.
Identifiers: Chrysanthemums.

Chrysanthemums were treated with liquid sludge for 84 days to determine its effectiveness as a fertilizer. Liquid sludge contains nutrients needed by field crops, but no data are available on the applicability of sludge to greenhouse plants. These plants were treated with either liquid sludge or inorganic fertilizers at doses of 50, 100, and 200 ml/week. Tap water was also used. The growth media were soil, sand, and peat. The variously fertilized plants were analyzed for concentrations of elements found in their leaves, stems, roots and flowers. Sludge-treated plants, regardless of the medium, had the highest nitrogen and lowest potassium concentrations in their leaves. Zinc concentrations in leaves increased with the sludge application rate. Elemental concentrations in stems and flowers, however, did not vary significantly with any particular fertilizer treatment. Concentrations of N, Ca, and Mg in roots were greater in sludge-treated plants. Iron and copper concentrations were high in roots. Iron and copper in the leaves of plants grown in sand increased with the sludge application rate. Plants treated with 50 and 100 milligrams of sludge/week had similar nutrient concentrations, but the leaves were healthier in the 50 ml/week plants. Sludge raised the pH level in all the media, but especially in peat. Extractable concentrations of potassium were usually lower,

and copper concentrations higher, in the sludge-treated media. Sand and peat media concentrations of calcium and magnesium increased as the sludge application rate increased. Trace element concentrations were not increased by using sludge fertilizer, nor was there any evidence of trace element toxicity. These experimental results indicated that chrysanthemum growth with liquid sludge as the only nutrient source was possible. (Collins-FIRL)

W77-09868

HOW SLUDGE CHARACTERISTICS AFFECT INCINERATOR DESIGN,

Hydrosience, Inc., Knoxville, Tenn.
R. G. Novak, J. J. Cudahy, M. B. Denove, R. L. Standifer, and W. E. Wass.
Chemical Engineering, Vol 84, No 10, p 131-136, May, 1977. 3 fig, 5 tab.

Descriptors: *Incineration, *Design criteria, *Sludge, Chemical properties, Physical properties, Dewatering, Equipment, *Sludge treatment, Polyelectrolytes, *Waste water treatment, Costs.

Incinerator design criteria are established based upon sludge characteristics. The moisture content of dewatered sludge directly influences incinerator size and auxiliary fuel costs. Various dewatering and conditioning systems were compared to determine the differences in sludge moisture content produced by each. Pressure filters produce the driest cake. This is an expensive dewatering method, but it conserves fuel. The resultant sludge can be burned in a relatively small incinerator. Dual-cell gravity/multi-roller press and belt press units require the lowest capital and labor expenditures. Centrifuge and vacuum filter methods are slightly more costly. All, except the pressure filter, produce cakes of approximately the same moisture content. The effects of conditioning chemicals on the quantity and composition of sludge, and on the ash produced, should also influence incinerator design. Multiple-hearth, fluid-bed, and rotary-hearth incinerators were described. The chemical composition of the sludge will determine whether or not secondary combustion on a multiple-hearth furnace is necessary. Other data necessary for choosing a particular incineration and disposal system are the ash content of the dry solids, the thermal characteristics of the ash, and the fraction of volatile and fixed carbon in the dry solids. (Collins-FIRL)

W77-09869

CONCURRENT WASTE WATER RENOVATION AND SOLID WASTE COMPOSTING,

Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 5D.

W77-09879

LAND APPLICATION OF MUNICIPAL SLUDGE,

New Jersey Inst. of Tech., Newark.
G. Dakes, and P. N. Cheremisinoff.
Water and Sewage Works, Reference Issue, p 38, 40-44, 46-47, April, 1977. 4 fig, 9 tab, 19 ref.

Descriptors: *Sludge disposal, *Municipal wastes, Incineration, Landfills, Fertilizers, Design, Economics, Water quality standards, Nutrients, Heavy metals, Pathogens, Monitoring, Microorganisms, Public health, Waste water disposal. Identifiers: Land application, Ocean dumping.

A summary was presented of information on the land application of municipal sludge. A brief history of sewage land application and an analysis of sludge characteristics were reviewed. Primary sludge contains high concentrations of fecal coliforms and lesser amounts of disease-causing organisms. These can be significantly removed through sedimentation. Sludge contains the major plant nutrients: nitrogen, phosphorus, and potassium.

The four alternative methods of sludge disposal were incineration, ocean dumpings, landfill, and land application. Properly operated and designed incinerators were able to meet particulate emission regulations, producing ash in volumes one-tenth that of dry sludge. However, disposal was still required, the removed water was a problem, and the process was expensive. Ocean dumping is to be completely phased out by 1981. Landfilling is an economic alternative and can accommodate concurrent disposal of municipal solid wastes. Pollution of groundwater from leachates and runoff is the most likely problem. Sludge must also be dewatered for this method. The costs to be considered for a land application system are sludge value, handling methods, transport, and distribution. Land acquisition and availability must also be considered. Any program must be prefaced by an understanding of the effects of metal toxicity to plants and the food chain. Several on-going experiments are seeking hard data on the subject. Various means have been suggested to avoid public health hazards. Means of pathogen destruction include long storage times, pasteurization, lime addition to raise pH, chlorination, and other chemical treatment. The final problem concerns the promotion of public acceptance. This should be solicited during developmental stages of a disposal program. (Collins-FIRL)

W77-09882

A NEW RAPID DIGESTION PROCESS FOR SEWAGE SLUDGE UTILIZATION (EINNEUES SCHNELLROTTE-VERFAHREN ALS BEITRAG ZUR WEITERGEHENDEN KLAERSCHLAMM-VERWERTUNG),

For primary bibliographic entry see Field 5D.

W77-09887

ADVANCE SEWER PLANNING FOR RIO DE JANEIRO COASTLINE,

ENCIBRA South America, Rio de Janeiro (Brazil).

For primary bibliographic entry see Field 5D.

W77-09890

WATERTIGHT CASE FOR POND LINERS.

For primary bibliographic entry see Field 5G.

W77-09891

EFFLUENT TREATMENT VERSUS DISPOSAL THROUGH LONG SEA OUTFALLS,

Watson (J. D. and D. M.), High Wycombe (England).
K. D. Staples.
Chemistry and Industry, No. 9, p 333-335, May, 1977.

Descriptors: *Outfalls, Water policy, Planning, *Treatment facilities, Sewage effluents, Oxygen demand, Solid wastes, Engineering, Hydrogen ion concentration, Costs, Physical properties, Chemical properties, *Waste water treatment, *Waste disposal.

Considerations in choosing sewage disposal by long sea outfalls or additional effluent treatment in coastal areas were presented. Environmental and economic concerns were discussed. Policies which attempted to accomplish zero discharge were found very expensive and of doubtful necessity. Limited treatment and longer outfalls were proposed for some areas. Several limitations on marine disposal were listed. Wastes with buoyant, identifiable solids usually require treatment by screening to avoid possible accumulation on shorelines. Heavier solids should be removed when a long outfall is used in areas with high flow variations, to avoid pipeline siltation. Effluents with high oxygen demand, high or low pH, and degradable toxic compounds should only be discharged in long outfalls where high initial dilution is possible. Long outfall engineering involves a high initial cost and low operating costs when

compared with land treatment plants. The outfall length would vary with effluent strength and character. Definitive cost evaluation must be made on the basis of individual situations. Cost factors may promote in-house industrial waste treatment with discharge to public sewer facilities for small waste quantities. Outfalls were considered most feasible when large waste quantities were disposed, or when wastes were easily degraded or oxidized at sea. They were also found viable when the waste source was reasonably close to the coast. (Collins-FIRL)

W77-09895

STERIODS AS SEWAGE SPECIFIC INDICATORS IN NEW YORK BIGHT SEDIMENTS,

National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.

For primary bibliographic entry see Field 5A.

W77-09901

CHEMICAL COMPOSITION OF SEWAGE SLUDGES AND ANALYSIS OF THEIR POTENTIAL USE AS FERTILIZERS,

Purdue Univ., Lafayette, Ind. Dept. of Agronomy.

For primary bibliographic entry see Field 5A.

W77-09904

CHANGES IN INORGANIC NITROGENOUS COMPOUNDS FROM SEPTIC TANK EFFLUENT IN A SOIL WITH A FLUCTUATING WATER TABLE,

Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Agronomy.

For primary bibliographic entry see Field 5B.

W77-09907

A MATHEMATICAL MODEL FOR WATER QUALITY IN A COASTAL REGION IN TERMS OF SEA BOTTOM WASTE DEPOSITS (KAITEI OSENBUSSHITSU NADO NO EIKYO O KORYO SHITA KAIKI NO SUISHITSU NO YOSOKU-MODERU NO KAIHATSU NI KANSURU KEN-KYU),

Public Works Research Inst., Tokyo (Japan).

For primary bibliographic entry see Field 5B.

W77-09911

REMOVAL OF NUTRIENTS FROM TREATED MUNICIPAL WASTE WATER BY WETLAND VEGETATION,

Water and Wastewater Technical School, Neosho, Mo.

For primary bibliographic entry see Field 5D.

W77-09916

OPTIONS FOR SLUDGE-TO LAND, SEA OR FIRE,

J. Pullin.

Surveyor, Vol. 149, No. 4423, p 7-9, March, 1977.

Descriptors: *Sludge disposal, *Landfill, *Fertilizers, *Incineration, Pollution abatement, Sewage effluents, Sludge treatment, Nitrogen, Phosphorus, Cadmium, Public health, Trace elements, Waste water treatment, Metals, Economics, Treatment facilities. Identifiers: *Ocean disposal.

For many years, sludge disposal has been a neglected step in sewage treatment processes. Increased sewage flows and stricter pollution standards have resulted in more efficient treatment methods, and consequently in more sludge. Four basic options for sludge disposal are using the sludge as landfill, using it as fertilizer, disposing of it in oceans, and incinerating it. The type of sludge produced and the geographical characteristics of a given area limit the choices. A 1970 report estimated that England and Wales produced about 1.1 million tons of sludge per year and that nearly 40%

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

was used as fertilizer. It should be noted that the fertilizing benefits of sludge nitrogen and phosphorus can be offset by the presence of toxic substances, such as heavy metals, which may enter the food chain. Cadmium concentrations in British sewage sludges may be as high as 50 milligrams/kilogram of dry solids. Though ocean disposal has been prominent in the past, incineration has become popular. The use of incineration is basically an economic decision. It was thought that sludge and domestic refuse could be incinerated together, but this was not very successful in Britain. Where sludges are not suitable for land application, incineration has a definite advantage. Land requirements are less, and the ash volume is much lower than the volume of sludge dried on beds. It appears that British practice will be to use incineration and ocean dumping in urban areas, for sludges which contain much industrial waste. Agricultural disposal will be used in areas where land is easily accessible and for sludge which is low in toxic materials. (Collins-FIRL)

W77-09918

AGRICULTURAL WASTES IN FISH FARMING. A COMMERCIAL APPLICATION OF THE CULTURE OF SINGLE-CELLED ORGANISMS FOR PROTEIN PRODUCTION. Agricultural Research Organization, Dor (Israel). Fish and Aquaculture Station.

G. Schroeder.

Water Research, Vol. 11, No. 4, p 419-420, 1977. 6 ref.

Descriptors: *Fish farming, *Farm wastes, *Fish food organisms, Pounds of fish per acre, Fish diets, Aquaculture, Bacteria, Protozoa, Productivity, Waste disposal, Recycling, Foreign countries.

Identifiers: *Israel (Fish production).

The use of cow dung and urine to promote bacteria and protozoa growth in Israeli fish farming ponds to enhance economically efficient protein production is described. Fluid animal waste containing both urine and feces has a large amount of suspendable material; approximately 20 to 30% of the dry matter remains in suspension when mixed with water, thus presenting an excellent substrate for the microorganisms. Standing crops of zooplankton and chironomid larvae were some 100-1000 times greater in manured ponds than in nonmanured ponds and produced fish yields greater than 30 kg/ha/day while chemical fertilization rarely produces 10 kg/ha/day. It appears that the organic carbon-based fraction of the dung-urine mixture is the key to the high fish yield. Production of bacteria and some protozoa species is not limited by light penetration; protozoa can feed either directly on dissolved nutrients or on bacteria. The short generation time of these microorganisms produces fish food organisms high in protein content, providing the fish with a diet twice as rich in protein as pelleted feeds conventionally used in Israeli fish culture. The high protein diet produced fish with a low fat content. Oxygen depletion is predicted by measuring the percentage of dry matter allowing additions of the dung-urine mixture at daily rates in excess of 2 tons/ha. (Auen-Wisconsin)

W77-10050

TACONITE TAILINGS DISPOSAL, RESERVE MINING COMPANY, SILVER BAY, MINNESOTA.

Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 5C. W77-10062

5F. Water Treatment and Quality Alteration

WATER SYSTEM VIRUS DETECTION. Organon Diagnostics, El Monte, Calif. For primary bibliographic entry see Field 5A.

W77-09636

OBSERVATIONS ON THE INTESTINAL PROTOZOA INFECTING MAN IN RHODESIA. Rhodesia Univ., Salisbury. Dept. of Medical Microbiology.

J. M. Goldsmid, S. Rogers, and K. Mahomed. South African Medical Journal, Vol. 50, No. 40, p 1547-1550, 1976. 3 fig, 1 tab, 29 ref.

Descriptors: Human diseases, Public health, *Protozoa, Potable water, Water quality. **Identifiers:** *Rhodesia, Entamoeba histolytica, Serology, Hookworm, Intestinal infections.

Humans in Rhodesia harbour a wide range of intestinal protozoa. Of the species included, Entamoeba histolytica, Entamoeba coli and Giardia lamblia have previously been recorded. Other species which are either rarely reported or which have previously never been reported from this country, include Trichomonas hominis, Chilomastix mesnili, Enteromonas hominis, Retortomonas intestinalis, Balantidium coli, Entamoeba hartmanni, Entamoeba histolytica Laredo, Endolimax nana, Dientamoeba fragilis and Isospora belli. The importance in Rhodesia of these species, and especially of E. histolytica, is discussed. (So. African Water Info Center)

W77-09691

CHLORINATION REACTIONS OF FULVIC ACIDS IN NATURAL WATERS. Municipal Water Works of Rotterdam (Netherlands).

J. J. Rook.

Environmental Science and Technology, Vol 11, No 5, p 478-482, May, 1977. 4 fig, 19 ref, 3 tab.

Descriptors: Natural streams, *Fulvic acids, *Chlorination, *Chemical reactions, Water pollution sources, Potable water, Waste water (Pollution), *Organic matter, Surface waters, Groundwater, Color, Halogens, *Chemical degradation.

Chlorination of both drinking waters and waste waters leads to the generation of various chlorinated degradation products of natural fulvic acids. Fulvic acids constitute the bulk of the organic matter in colored surface or groundwaters. Metadihydroxybenzene structures are proposed as main reactive sites of the molecule. Experimental evidence is presented for possible reaction pathways leading to haloforms and other chlorinated by-products. (Witt-IPC)

W77-09741

RESEARCH AND DEVELOPMENT OF AN ELECTROCHEMICAL BIOCIDES, FINAL REPORT.

Life Systems, Inc., Cleveland, Ohio.

For primary bibliographic entry see Field 5D.

W77-09771

WATER PURIFYING SYSTEMS.

J. D. Smith.

U.S. Patent No. 4,002,566, 7 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 778, January 11, 1977.

Descriptors: *Patents, *Water purification, *Water treatment, Water quality control, *Aeration, *Biological treatment, *Waste water treatment, Bacteria, Cultures.

The object of the invention is to provide a water purifying system which includes flowing the water through a path supporting a bacteria culture. The water is aerated in the path upstream of the bacteria culture. The bacteria culture constantly and continuously cleans and purifies the water. The invention relates in general to water purification systems but more particularly related to but is not

limited to aquariums, swimming pools and other such systems. (Sinha-OEIS)

W77-09808

PHOTODYNAMIC INACTIVATION OF INFECTIOUS AGENTS. FMC Corp., Santa Clara, Calif. Environmental Engineering Lab.

For primary bibliographic entry see Field 5D.

W77-09883

PROTOZOAN AND HELMINTHIC INFECTIONS OF THE INTESTINES OF HUMANS IN THE INYANGA AREA OF RHODESIA. Rhodesia Univ., Salisbury. Dept. of Medical Microbiology.

For primary bibliographic entry see Field 5G.

W77-10076

CALCIUM CARBONATE PRECIPITATION KINETICS, PART I, PURE SYSTEM KINETICS. Cape Town Univ. (South Africa). Dept. of Civil Engineering.

P. L. K. Sturrock, L. Benjamin, R. E. Loewenthal, and G. R. Marais.

Water SA, Vol. 2, No. 3, p 101-109, July 1976. 9 fig, 1 tab, 8 ref.

Descriptors: *Calcium carbonates, *Kinetics, *Chemical precipitation, Supersaturation, Hard water, Water softening, Model studies, Calcite, *Water treatment, Ions.

The kinetics of calcium carbonate precipitation was investigated in seeded batch test experiments at 20°C. Two postulates governing precipitation rates were investigated: (1) that rate is a function of seed mass and supersaturation as postulated by Nancollas and Reddy for CaCO₃ precipitation, and (2) that rate is governed by the mass of seed and a charge on the seed surface as postulated by Davies and Jones for AgCl precipitation. (So African Water Info Center)

W77-10087

5G. Water Quality Control

A GUIDE TO AERATION/CIRCULATION TECHNIQUES FOR LAKE MANAGEMENT. Tetra Tech., Inc., Lafayette, Calif.

M. Lorenzen, and A. Fast.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 126, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/3-77-004, January 1977. 142 p, 51 fig, 5 tab, 93 ref, 4 append. IBA031, 68-03-2192.

Descriptors: *Specifications, Equipment, *Methodology, *Water treatment, *Aeration, *Water circulation, *Lakes, Destratification, Hypolimnion, Estimated costs, Size, Design, Oxygenation, Oxygen requirements, Mixing, *Circulation.

Identifiers: *Lake rehabilitation, Lake management, Case studies.

In a theoretical and practical review of lake rehabilitation by aeration and circulation application techniques and a discussion of problems amenable to solution or control by these techniques are related to resultant benefits that may be expected, appropriateness of various techniques, and equipment design. Destratification procedures intended to either mix the lake or to provide aeration without maintaining the normal thermal structure are discussed together with systems ranging from high energy mixing devices to low energy aeration procedures (including both mechanical pumps and compressed air). Destratification systems can be used to control excessive algal growth under certain circumstances and to maintain aerobic conditions; however, cold water cannot be maintained

when complete mixing is achieved, and could harm certain fish species. Both air and oxygen systems are available to maintain normal thermal stratification of a lake while adding oxygen to the hypolimnion. Whether to destratify or to maintain stratification depends on water uses and the extent of the problems. Examples of methodologies and devices applied to specific lakes, and methods of estimating costs, are included. (Auen-Wisconsin) W77-09603

NUTRIENT DIVERSION: RESULTING LAKE TROPIC STATE AND PHOSPHORUS DYNAMICS.

Washington Univ., Seattle. Dept. of Civil Engineering. E. B. Welch.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 645. Price codes: A05 in paper copy, A01 in microfiche. Ecological Research Series EPA-600/3-77-003, January 1977. 102 p, 27 fig, 16 tab, 27 ref. 1BA031, EPA R-800512.

Descriptors: *Nutrient removal, *Lakes, *Phosphorus, Diversion, *Washington, Sedimentation, Iron, *Cycling nutrients, Mesotrophy, *Trophic level.

Identifiers: *Lake Sammamish(Wash), *Waste water diversion.

About 7000 kg/yr of phosphorus was diverted from Lake Sammamish, Washington, in 1968. But reduced phosphorus loading had no measurable impact on the total phosphorus and chlorophyll-a concentration, water transparency or hypolimnetic oxygen deficit rate, although the cyanophytes declined by over 40%. The lake remains mesotrophic with a mean summer Secchi disc transparency of 3.3 m and a maximum of near 6 m, a state unchanged since early in this century and possibly since the beginning of permanent settlement in the watershed. Maintenance of lake trophic stability is attributed largely to the constancy of the winter phosphorus concentration, which in turn is controlled by high anaerobic release rates from the sediment in summer, but more importantly, high sedimentation rates following autumn turnover. Most of the phosphorus fluctuation was correlated with iron, which controls the anaerobic release and aerobic sedimentation of phosphorus. Although the effect of a one-third reduction or increase, in phosphorus input was not apparent, loading without diversion would well have exceeded the stability mechanisms(s) for water-column phosphorus. A mathematical model simulated phosphorus and chlorophyll-a concentrations reasonably well, but served primarily to study seasonal dynamics of the system. (Auen-Wisconsin) W77-09604

STUDIES ON THE RECLAMATION OF STONE LAKE, MICHIGAN.

Notre Dame Univ., Ind. T. L. Theis, and J. V. DePinto.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 198. Price codes: A04 in paper copy, A01 in microfiche. Ecological Research Series EPA-600/3-76-106, November 1976. 94 p, 29 fig, 9 tab, 40 ref, append. 1BA031, EPA R-801245.

Descriptors: *Water pollution treatment, *Eutrophication, *Cycling nutrients, *Lake sediments, *Sealants, Michigan, Clays, Fly ash, Nutrient removal, Chemical precipitation, Phosphorus, Nitrogen, Cost-benefit analysis. Identifiers: *Lake restoration, *Sedimentary nutrients, Stone Lake(Mich), Nutrient regeneration.

Particulate materials, such as certain types of fly ash or clays, were shown to be potentially effective lake restoration tools for controlling cycling of phosphorus and nitrogen from eutrophic sedi-

ments in Stone Lake, Michigan. Usually a 2 to 5 cm layer of material was needed to control phosphate release. Supplemental additions of lime or alum enhanced phosphate removal from the overlying water. Sandy shoreline sediments low in water and organic matter have a low pollution potential and should not usually require covering with a particulate layer. A cost-benefit analysis, using the criteria of ease in handling and application, fishery response to treatment, removal of nutrients, effects on recreation, and aesthetic value compares costs of fly ash, fly ash and lime, clay, dredging, nutrient inactivation combined with aeration, mechanical harvesting with aeration, replacing the lake water, and a soil and plastic barrier. Laboratory data indicate that there may be potentially harmful effects from water soluble extracts of fly ash, particularly sulfur and various heavy metals. Short-term extremes of pH may also affect biota unfavorably. The side-stream method of lake reclamation for removal of phosphorus is also discussed, giving costs and its feasibility. (Auen-Wisconsin) W77-09605

A METHODOLOGY FOR COMPARATIVE EVALUATION OF WATER QUALITY INDICES, Worcester Polytechnic Inst., Washington, D. C. Project Center.

For primary bibliographic entry see Field 5A. W77-09632

THE TUGELA-VAAL STATE WATER SCHEME AS A BILHARZIA RISK (DIE TUGELA-VAAL-STAATSWATERSKEMA AS 'N BILHARZIARISIKO).

South African Medical Research Council, Potchefstroom.

S. J. Pretorius, G. Oberholzer, and J. A. Van Eeden.

South African Medical Journal, Vol. 50, No. 25, p 968-972, 1976. 2 fig, 2 tab, 7 ref.

Descriptors: Inter-basin transfers, *Snails, Intermediate hosts, Africa, *Public health, Surveys, Human diseases.

Identifiers: Sterkfontein Dam, Spioenkop Dam, *Tugela River-Vaal River water scheme(So Afr), Bulinus(Physopsis) africanus, *South Africa, *Bilharziasis, *Schistosomiasis.

The Tugela-Vaal River water scheme constitutes a possible source for the introduction of bilharziasis into an area where the disease is at present not endemic. A survey was made of the snail species in the area encompassed by the scheme. Although Bulinus (Physopsis) africanus (a host of Schistosoma species responsible for urinary bilharzias) was found in the proposed source area of the water scheme, it is not possible at this stage to determine with certainty whether this host will be introduced over the Drakensberg escarpment into the Orange Free State. However, this is a distinct possibility, and it is discussed in relation to ecological factors. (So. African Water Info Center) W77-09690

OBSERVATIONS ON THE INTESTINAL PROTOZOA INFECTING MAN IN RHODESIA, Rhodesia Univ., Salisbury. Dept. of Medical Microbiology.

For primary bibliographic entry see Field 5F. W77-09691

EFFECT OF LEACHING FRACTION ON RIVER SALINITY.

Agricultural Research Service, Riverside, Calif. Salinity Lab.

D. L. Suarez, and J. D. Rhoades.

Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 103, No. IR2, Proceedings Paper 13017, p 245-257, June 1977. 7 tab, 9 ref, 2 append.

Descriptors: *Drainage water, *Leaching, *Irrigation engineering, *Salinity, Management, Soil chemical properties, Calcium carbonate, Porosity, Rivers, Water quality, Return flow, Drainage, Root zone, Saline soils, Gypsum, Model studies.

Identifiers: Saturation(Chemical).

The effects of 0.10 and 0.40 irrigation leaching fraction management on amounts of salt precipitated in the soil and river channel and compositions of drainage and river water were calculated for each of the three river types routed through nine successive hypothetical irrigated valleys. The calculations assume dissolution of CaCO₃ (in the soil) and return of irrigation drainage waters. Rivers undersaturated with CaCO₃ were slightly less saline under low versus high leaching. Rivers saturated with CaCO₃ were unaffected by irrigation management. Rivers saturated with CaCO₃ and approaching saturation with gypsum experienced substantial reductions in salinity under low leaching compared to high leaching. For CaCO₃-saturated rivers, a change from high to low leaching results in a rootzone soil porosity reduction of 0.008% more per year. For rivers that result in the precipitation of gypsum, soil porosity was reduced about 0.08% more per year for low as compared to high leaching. (Visocky-ISWS) W77-09697

FLUSHING CHARACTERISTICS OF A MISSISSIPPI DEAD-END CANAL SYSTEM, University of Southern Mississippi, Hattiesburg. Dept. of Geology.

For primary bibliographic entry see Field 5B. W77-09721

LOGGING ROADS AND PROTECTION OF WATER QUALITY.

Arnold, Arnold and Associates, Seattle, Wash.; and Dames and Moore, Seattle, Wash.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-243 703. Price codes: A14 in paper copy, A01 in microfiche. Environmental Protection Agency, Region X, Seattle, Wash., Water Div. Report EPA 910/9-75-007, March, 1975. 312 p, 42 fig, 128 ref, 16 tab.

Descriptors: *Water quality, *Roads, *Lumbering, *Reviews, Forest management, *Road construction, Maintenance, Erosion control, Water pollution sources, Pacific Northwest U.S., Water quality control, Planning, Road design, Chemicals.

This is a state-of-the-art review of methods, procedures, and practices for protecting water quality during the planning, design, construction, reconstruction, use, and maintenance of logging roads. Most of the methodology is also applicable to other forest roads. The report is divided into two parts. The first part provides a general perspective on the physical features and conditions in the Pacific Northwest which are relevant to water quality protection and logging roads. The second part outlines specific methods, procedures, criteria, and alternatives for reducing the degradation of water quality. Topics covered in this part include road planning, design, construction, and maintenance including the use of chemicals on roads. Of all the silvicultural activities, logging roads are the principal source of man-caused sediment. (Witt-IPC) W77-09725

HOW TO REDUCE WATER AND RAW MATERIAL CONSUMPTION IN PAPERMAKING (COME RIDURRE I CONSUMI D'ACQUA E DI MATERIE PRIME IN CARTIERA), Cartiere Ambrogio Binda S.p.A., Milan (Italy).

For primary bibliographic entry see Field 3E. W77-09738

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

FOREST HARVEST, RESIDUE TREATMENT, REFORESTATION, AND PROTECTION OF WATER QUALITY.

Montgomery (James M.), Inc., Boise, Idaho. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 393, Price codes: A13 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA 910/9-76-020, April, 1976. 273 p, 13 fig, 15 tab, 566 ref.

Descriptors: *Water quality, *Lumbering, *Forest management, *Water pollution, *Reviews, *Reforestation, Surface runoff, Soil erosion, Forests, Forest watersheds, Pacific Northwest U.S., Hydrology, Water pollution sources, Wood wastes, Waste disposal, Water quality control, Climates, Geology, Forest soils, Bibliographies. Identifiers: *Lumbering wastes.

This is a state-of-the-art review of methods, procedures, and practices for protecting water quality during logging, logging residue treatment, and reforestation activities. A description is given of the Pacific Northwest by dividing the region into thirteen subregions based on similar forest species, climate, geology, and soil parent material. This is followed by a discussion of the interaction of water quality problems with forest management, soil erosion, and hydrology. Current forest practices in the Pacific Northwest are described and related to their water quality impacts. The study concludes with a section on the planning and management methods that can be used to reduce and prevent pollution from logging, residue management, and reforestation. (Witt-IPC) W77-09756

EFFECTS OF LOG HANDLING AND STORAGE ON WATER QUALITY.

Corvallis Environmental Research Lab., Oreg. For primary bibliographic entry see Field 5C. W77-09760

A STUDY TO EVALUATE THE INTENSITY OF AN ALTERNATE METHODS FOR NEUTRALIZATION OF DOD AIRCRAFT FUEL SPILLS, PHASE I.

Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div. V. J. Ciccone, and A. P. Graves.

Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-025 937, Price codes: A05 in paper copy, A01 in microfiche. DOD Aircraft Ground Fire Suppression and Rescue Office, Report DOD AGFSRS 76-2, February 1976, 86 p, 18 tab, 27 fig, 5 ref.

Descriptors: *Oil, *Oil spills, *Fuels, Aircraft, *Airports, Industrial wastes, Industrial water, Transportation, Trapping, On-site investigation, Oil-water interfaces, Analytical techniques, *Neutralization, Pollution abatement.

Identifiers: *Fuel spill problem, Fuel volume, Frequency of spills, *Fuel spill neutralization, *Fuel spill collection, Absorbents, Vacuum collection, Wringers, Fuel/water separators, Coalescent filters, Plate separators, Tank separators, Distillation unit, Water booms, Oil skimmer.

The magnitude of the fuel spill problem at DOD airfields is described in terms of fuel volume, frequency of occurrence, and specific site of occurrence. In addition, a list of currently available methods for neutralization of fuel spills was prepared, together with a study of the practicality, feasibility and cost effectiveness of methods for collection, treatment, or neutralization of fuel pools resulting from accidental fuel spills at airfields. (Katz) W77-09774

ESTIMATION OF PERMISSIBLE CONCENTRATIONS OF POLLUTANTS FOR CONTINUOUS EXPOSURE.

Research Triangle Inst., Research Triangle Park, N.C. For primary bibliographic entry see Field 5A. W77-09788

APPLICATION OF THE ROTATING FLIGHTED CYLINDER TO LIVESTOCK WASTE MANAGEMENT.

Oregon State Univ., Corvallis. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5D. W77-09795

WATER TREATMENT SYSTEM WITH PROLONGED AERATION.

A. Wikey.

Descriptors: *Patents, *Water treatment, *Water purification, *Aeration, *Electrolysis, Water quality control, *Water pollution control, Bubbles, Gases, Baffles equipment.

Equipment for and methods of treating, aerating, and purifying water over prolonged periods of time are described. A new and improved water treatment system is provided where the object is to extract greater levels of aeration from oxygen bubbling through the water. One or a vertical series of baffles placed over an electrolyzing unit controls a passage of oxygen out of water and distribute the aerated water within a body of water. Water is drawn into an inlet pipe and broken down into the gaseous oxygen by electrolysis. The resulting oxygen bubbles through and thereby aerates the water. The aerated water is then discharged. (Sinha-OEIS) W77-09818

AERATING APPARATUS.

J. F. Boward, Jr. U.S. Patent No. 4,005,015, 5 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 954, no 4, p 1659, January 25, 1977.

Descriptors: *Patents, *Water treatment, *Aeration, *Water pollution treatment, Water quality control, *Water purification, Water circulation, Ponds, Shallow water.

Aeration of stagnant ponds of water is desirable to promote growth of fish and prevent growth of algae and/or fungus. This invention is directed to apparatus for aerating shallow bodies of water and includes a pump having an inlet and an outlet. A first conduit has one end connected to the pump outlet and its other end is connected to a valve for introducing air and/or chemicals into a flowing stream of water moving in a downward direction toward liquid level. The valve is supported at an elevation above the water level. A distribution conduit is connected downstream from the valve and has a greater flow capacity than the first conduit. A submersible distributor head is connected to the distribution conduit. The head has a chamber provided with an inlet and an outlet. The chamber inlet is at an elevation lower than the outlet. The outlet is substantially smaller in size. The apparatus is particularly designed to be portable. (Sinha-OEIS) W77-09819

WATERTIGHT CASE FOR POND LINERS.

Chemical Week, Vol. 120, No. 23, p 40, June, 1977.

Descriptors: *Linings, *Plastics, Ponds, Landfills, Leachates, Water pollution control, Reservoirs, Construction materials, Costs, Waste storage, Physical properties, Waste disposal.

A progress report was made on the usage of plastic linings in ponds, landfills, and reservoirs. About 110 million square feet was marketed in 1976. The amount could rise to nearly one billion square feet by 1980. Various manufacturers predict annual market growth rates of 15-20%. Groundwater protection regulations were one reason for the emphasis on liners. Stricter regulatory and monitoring requirements have forced a search for means to create leak-secure ponds. This has been especially true for landfill construction and the storage of hazardous materials. Reservoirs would also be covered to prevent vandalism, algal growth, evaporation, and contamination from airborne pollutants. Polyvinyl chloride and polyethylene liners have been the major alternative to traditional liner materials. New materials such as thermoplastics and elastomers are becoming popular. Greater weatherability and resistance to a wider range of wastes outweigh cost considerations. They also provide simpler and more secure seam sealing methods. Cost comparisons were provided for the traditional and new plastic liner materials. (Collins-FIRL) W77-09891

SOUTH BEND'S INDUSTRIAL SURVEILLANCE WASTE WATER MONITORING PROGRAM.

South Bend Bureau of Wastewater, Ind. For primary bibliographic entry see Field 5A. W77-09919

CONSTRUCTION MANAGEMENT FOR WASTE WATERTREATMENT PLANTS.

CM Associates, Inc., Houston, Tex. For primary bibliographic entry see Field 5D. W77-09920

IMPACT OF MUNICIPAL WATER AND SEWAGE CHARGES ON INDUSTRY.

Packard and Anderson Engineers, Auburn, N. Y. R. J. Schaffer, Jr., and B. L. Pickard. Water and Sewage Works, Reference Issue, p 107-109, April, 1977. 4 tab.

Descriptors: *Water costs, *Cost allocation, Water policy, *Water rates, Water consumption (Except consumptive use), Water resources, Waste treatment, Industrial water, Industrial wastes, Water users, Municipal water, *Waste water treatment.

The economics of municipal waste water treatment can be staggering. One aspect of the issue is that of charges to industrial users of the systems. Increased costs for power, labor, and chemicals, in addition to federal stipulations for cost apportionment, have increased the financial responsibility of industrial customers. Minimizing such costs would necessitate a detailed analysis of water uses and waste water generation by each facility. Determination of the best means to monitor the strengths and quantity of waste water disposed to municipal systems would follow. Pretreatment of specific wastes of separate waste water treatment facilities may be justified. Alternate solutions include water metering by uses to separate water used and disposed to the system from that used and disposed by other means. The total flow of municipal water used and that of waste water discharged to sewers could be metered. Fixed charges could be negotiated, based on accurate flow data. These choices involve several considerations. The type of metering device chosen would depend on the selected solution. Reduction of municipal water usage and the development of a private additional water source should be investigated. Industries should not overlook the possibility of reducing waste water flow to municipal sewers. A case study proved that even a small plant could benefit from improvements and recover costs. (Collins-FIRL) W77-09921

CROSS CANADA REPORT,

M. Overment.
Water and Pollution Control, Vol 115, No 3, p 14-19, 21, March, 1977. 2 fig, 1 tab.

Descriptors: *Environmental control, *Pollution abatement, *Water pollution control, *Legislation, Waste treatment, Waste disposal, Costs, *Treatment facilities, Flood control, Economics, Planning, *Waste water treatment.

A review was made of the water and sewage activities in Canada, as well as pollution control efforts. Spending on various programs reached \$2.5 billion in 1976 due to an emphasis on cleanup and prevention. Spending for sewage treatment was as high as \$1.2 billion. The Fisheries Act and the Canadian Waters Act were the basic enabling legislation for programs in water pollution control. The Ocean Dumping Control Act and the Environmental Contaminants Act, passed in the 1975-76 fiscal year, have affected flood control, sewage treatment, ocean dumping, and pollution control. Various activities in Province were described with a financial breakdown for water and sewage treatment. (Collins-FIRL)
W77-09923

POTENTIAL ENVIRONMENTAL CONSEQUENCES OF TERTIARY OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W77-10023

IDENTIFICATION AND ANALYSIS OF MID-ATLANTIC ONSHORE OCS IMPACTS.
Resource Planning Associates, Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W77-10027

EVALUATION OF UTILITY EQUIPMENT FOR HARBOR OIL SPILL REMOVAL/RECOVERY SYSTEMS,
Civil Engineering Lab. (Navy), Port Hueneme, Calif.
S. C. Garg.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-026 252, Price codes: A06 in paper copy, A01 in microfiche. Technical Note no TN-1443, June 1976. 118 p, 37 fig, 15 ref, 3 append.

Descriptors: *Oil spills, *Harbors, *Estuaries, *Water pollution control, Cleaning, Equipment, Skimming.
Identifiers: *Oil booms, *Oil spill removal equipment, Utility equipment.

The following items of equipment for harbor oil spill cleanup operations were evaluated: a power assistance unit for deploying and retrieving boom, a 20-foot utility boat, a 28-foot flatboat, three boom mooring systems, a dust abatement attachment for a sorbent distributor, and the associated connectors, shackles, and lines. A description of the test program, the test results, and recommendations for deployment, use, and retrieval of the equipment are presented. Manpower and time measurements for deployment and retrieval were made. Deficiencies in equipment, as observed, and methods to remove the deficiencies are described. (Sinha-OEIS)
W77-10031

OIL AND GAS SEEPS IN ALASKA. ALASKA PENINSULA, WESTERN GULF OF ALASKA,
Bureau of Mines, Anchorage, Alaska. Alaska Field Operation Center.
For primary bibliographic entry see Field 5B.
W77-10033

SIMULATION FACTORS INVOLVED IN OCEAN THERMAL POWER PLANTS,
Naval Academy, Annapolis, Md. Dept. of Naval Systems Engineering.
For primary bibliographic entry see Field 5B.
W77-10034

ANIMAL COLONIZATION OF MAN-INITIATED SALT MARSHES ON DREDGE SPOIL,
North Carolina State Univ., Raleigh. Sea Grant Program.
For primary bibliographic entry see Field 2L.
W77-10035

BOTTOM WITHDRAWAL CAN ENHANCE LAKE WATER QUALITY,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
Water and Sewage Works, Vol. 123, No. 11, p. 58-60, 1976. 2 fig., 3 ref.

Descriptors: *Water quality control, *Reservoirs, *Equipment, *Methodology, Hypolimnion, Withdrawal, *Arkansas, Nutrient removal, Algal control, Taste, Odor, Iron, Manganese, Lakes.
Identifiers: *Prairie Grove Lake(Ark).

Substantial bottom concentrations of iron and manganese in Prairie Grove Lake, Arkansas, a 4060 acre-ft water supply reservoir, forced in treatment plant operator to choose between two alternatives: withdrawing water from near the lake surface, with severe taste and odor problems, or withdrawing water from the hypolimnion. An experimental bottom withdrawal system was installed, consisting of shroud with two 48-inch diameter corrugated metal pipes attached to each side of the 'morning glory' tower. Examination of the feed stream phosphorus content showed it to be half that found in the reservoir discharge. Reduction of phosphorus in the lake would reduce nuisance algae growth and taste and odor problems caused by the algae. Preliminary examinations indicated that iron and manganese concentrations in the hypolimnion were lowered. The 'morning glory' tower spillway design, in which spilled water falls about 40 ft then moves through 300 ft of 36-inch concrete pipe prior to discharge, makes it an excellent stripping device for carbon dioxide and hydrogen sulfide. The withdrawal system does not affect chemocline or thermocline stratification, nor does it oxygenate the lower reaches of the reservoir. It was designed only as an aid to maintain water quality and was not intended as a lake restoration method. (Auen-Wisconsin)
W77-10049

ALGAL NUTRIENT AVAILABILITY AND LIMITATION IN LAKE ONTARIO DURING IFGYL PART 1, AVAILABLE PHOSPHORUS IN URBAN RUNOFF AND LAKE ONTARIO TRIBUTARY WATERS,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W77-10052

BAY SPRINGS LAKE WATER-QUALITY STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 5B.
W77-10055

BUTOXYETHANOL ESTER OF 2,4-D FOR CONTROL OF EURASIAN WATER MILFOIL,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 4A.
W77-10057

DESTRUCTION OF VEGETATION ON DAMS OF THE GORKY HYDROELECTRIC POWER PLANT WITH HERBICIDES,
For primary bibliographic entry see Field 4A.
W77-10059

PROTOZOAN AND HELMINTHIC INFECTIONS OF THE INTESTINES OF HUMANS IN THE INYANGA AREA OF RHODESIA,
Rhodesia Univ., Salisbury. Dept. of Medical Microbiology.
R. J. MacCabe, and J. M. Goldsmid.
South African Medical Journal, Vol 50, No 20, p 779-780, 1976. 1 tab, 17 ref.

Descriptors: *Protozoa, Human parasites, *Public health, Potable water, Water quality, Africa, E. coli, *Human diseases.
Identifiers: Entamoeba coli, Inyanga, *Rhodesia, *Helminthic infections, Hookworm.

A survey of the protozoan and helminth species which infest the intestines of the people in the Inyanga area of Rhodesia has revealed a wide range of species. Of the protozoa, Entamoeba coli was by far the commonest species encountered (45.8%), and of the helminths, hookworms (8.2%) were the most common. (So African Water Info Ctr)
W77-10076

CONTROLLING THE ACCESS OF NUTRIENTS FROM POINT AND DIFFUSED SOURCES WITH SPECIAL REFERENCE TO THE PRETORIA/WITWATERSRAND/VEREENIGING REGION,
Johannesburg City Council(South Africa).
Water SA, Vol. 2, No. 4, p 145-149, October 1976. 4 tab, 6 ref.

Descriptors: *Nutrients, *Phosphorus compounds, Costs, Sewage treatment, Biological processes, Eutrophication, Water reuse, Urbanization, Human population, Urban runoff, Africa, Water pollution control, Waste water treatment.
Identifiers: South Africa, Witwatersrand.

The present contribution of phosphorus compounds of effluent origin to rivers and impoundments in the industrialized Pretoria/Witwatersrand/Vereniging region is estimated on the basis of the size of the contributing population. Demographic projections are used to estimate figures for the year 2000. Costs of alternative wastewater treatment technologies are compared. Priority research areas are identified. (So African Water Info Center)
W77-10082

THE CASE FOR THE EXPANDED STUDY OF FRESHWATER POLLUTION ZOOLOGY,
Zululand Univ., Empangeni (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-10086

ENVIRONMENTAL SCIENCES.
Council for Scientific and Industrial Research, Pretoria (South Africa).
For primary bibliographic entry see Field 6G.
W77-10098

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPTIMAL OPERATION OF FLOOD CONTROL SYSTEMS, (FINAL REPORT; V.II),
Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering.

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

For primary bibliographic entry see Field 4A.
W77-09927

6B. Evaluation Process

THE FUNCTIONAL AND AESTHETIC USES OF TWO CACHE VALLEY, UTAH, CANALS, Utah State Univ., Logan. Dept. of Landscape Architecture and Environmental Planning. J. S. Culbertson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 358. Price codes: A04 in paper copy, A01 in microfiche. Master of Landscape Architecture, 1975. 58 p, 12 fig, 4 tab, 16 ref. OWRT A-017-UTAH(2), 14-31-0001-3845.

Descriptors: *Recreation demand, Recreation facilities, Parks, Canal design, *Utah, *Multiple-purpose projects, Aesthetics, *Irrigation canals. Identifiers: *Cache Valley(Utah).

This research is a local supplement to a wider-focused report on multiple uses of irrigation canals (see W75-04939), primarily concerned with recreational uses. Increasing magnitude and variety of use generated several use conflicts, and the need for a closer look at canal-oriented activities arose. The intent of the study is to show local residents and planning officials the present physical condition of local canals and canal corridors, their present multiple uses, the importance of Cache Valley irrigation canals as recreation systems, and some possible future canal use alternatives. A proposal to consolidate three local canals into one large concrete highline canal has been made by a few members of irrigation companies. Water loss due to seepage (approximately 30 percent) and increased water pressure in the valley below the canals are the reasons for the proposal. From an engineering point of view this proposal is logically sound. Economically, one must look at the cost of construction of 9.7 miles of concrete canal versus the long term rewards of such construction, especially irrigation efficiencies and water demands of Cache Valley. Water demands have marginally exceeded water supply in only a few drought years, and water excess is common. Average excess was 11,220 acre feet for the upper canal and average deficit was 228 acre feet. Sprinkler irrigation distributes the water more evenly and uses less water; the problem of water deficit could be minimized by using trickle systems. The 30 percent water loss should not be considered all wasted. Seepage water supports trees and other dense stands of vegetation, which attract birds and other wildlife to the canals. Proper impact evaluation and cost effectiveness should be required before any serious efforts towards construction of highline canal system are made.

W77-09796

ARID LANDS OF SUB-SAHARAN AFRICA. National Academy of Sciences, Washington, D.C. Commission on International Relations. For primary bibliographic entry see Field 6E. W77-09934

WATER RESOURCES ASSESSMENT METHODOLOGY (WRAM)—IMPACT ASSESSMENT AND ALTERNATIVE EVALUATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 6G. W77-09985

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

URBAN RUNOFF POLLUTION CONTROL—TECHNOLOGY OVERVIEW, Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.

For primary bibliographic entry see Field 5D. W77-09823

STORM WATER MANAGEMENT MODEL: LEVEL I—COMPARATIVE EVALUATION OF STORAGE-TREATMENT AND OTHER MANAGEMENT PRACTICES, Florida Univ., Gainesville. Dept. of Environmental Engineering Science. For primary bibliographic entry see Field 5D. W77-09824

NATIONWIDE EVALUATION OF COMBINED SEWER OVERFLOWS AND URBAN STORM-WATER DISCHARGES. VOLUME II: COST ASSESSMENT AND IMPACTS, Florida Univ., Gainesville. Dept. of Environmental Engineering Science. For primary bibliographic entry see Field 5D. W77-09874

IMPACT OF MUNICIPAL WATER AND SEWAGE CHARGES ON INDUSTRY, Packard and Anderson Engineers, Auburn, N. Y. For primary bibliographic entry see Field 5G. W77-09921

TACONITE TAILINGS DISPOSAL, RESERVE MINING COMPANY, SILVER BAY, MINNESOTA, Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 5C. W77-10062

IMPACT OF ECONOMIC RISKS ON BOX CULVERT DESIGNS—AN APPLICATION TO 22 VIRGINIA SITES, Water Resources Engineers, Inc., Springfield, Va. For primary bibliographic entry see Field 8B. W77-10067

6D. Water Demand

AN APPROACH TO REDUCE WATER CONSUMPTION IN NEIGHBORHOODS THROUGH REUSE, Sir Venkateswara Univ., Tirupati (India). Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W77-09855

WATER-RESOURCES APPRAISAL OF THE CARSON RIVER BASIN, WESTERN NEVADA, Geological Survey, Carson City, Nev. Water Resources Div. For primary bibliographic entry see Field 4A. W77-09992

WATER RESOURCES OF THE UMATILLA INDIAN RESERVATION, OREGON, Geological Survey, Portland, Ore. Water Resources Div. For primary bibliographic entry see Field 4A. W77-10011

6E. Water Law and Institutions

CROSS CANADA REPORT, For primary bibliographic entry see Field 5G. W77-09923

ARID LANDS OF SUB-SAHARAN AFRICA. National Academy of Sciences, Washington, D.C. Commission on International Relations. Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 594,

Price codes: A03 in paper copy, A01 in microfiche. Staff final report, NAS/NRC Advisory Panel of the Board on Science and Technology for International Development, Prepared for the Agency for International Development, 1975. 36 p.

Descriptors: *Arid lands, *Africa, *Droughts, *Long-term planning, *Water resources development, Climatic data, Meteorological data, Food abundance, Productivity, Manpower, Education, Transportation, Communication, Data collections, River basin development, Watersheds(Basins), Public health. Identifiers: Board of Science and Technology for International Development(BOSTID), *Sahel.

Problems of long-term development of the Sahel are discussed, and conclusions are presented. The current weather pattern in the Sahel suggests severe drought cycles will continue and should be included as a factor in long-range planning. Food security, education in rural areas, and transportation and communication systems must be upgraded. Improvements in the predictive capacity of meteorological services, information on soil and water resource development and food production capacity are also crucial. Development of large-scale water resources projects in the great river basins of the area must not cause neglect of opportunities for small-scale water resource development. Recommendations are outlined as part of a long-term strategy for development. (Jahns-Arizona) W77-09934

FEDERAL PLAN FOR ACQUISITION OF WATER DATA BY FEDERAL AGENCIES, FISCAL YEAR 1977.

Geological Survey, Reston, Va. Water Resources Div. For primary bibliographic entry see Field 7C. W77-10013

6G. Ecologic Impact Of Water Development

THE ORIGIN AND STRUCTURE OF AMERICAN ARID-ZONE ECOSYSTEMS. THE PRODUCERS: INTERACTIONS BETWEEN ENVIRONMENT, FORM AND FUNCTION, San Diego Univ., Calif. Dept. of Biology. For primary bibliographic entry see Field 2A. W77-09933

WATER RESOURCES ASSESSMENT METHODOLOGY (WRAM)—IMPACT ASSESSMENT AND ALTERNATIVE EVALUATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. R. C. Solomon, W. J. Hansen, L. W. Canter, B. K. Colbert, and S. E. Richardson. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 677. Price codes: A08 in paper copy, A01 in microfiche. Technical Report Y-77-1, February 1977. 150 p, 5 fig, 12 tab, 25 ref, 4 append.

Descriptors: *Environmental effects, Environment, Planning, *Water resources, *Evaluation, *Methodology, *Alternative planning, Reviews. Identifiers: *Environmental impact assessment.

The U.S. Army Corps of Engineers has been directed by various legislation, acts, and regulations to conduct systematic and comprehensive environmental planning for its activities. The thrust of this study has been to pull together the state of the art and to synthesize a water resources assessment methodology (WRAM) for impact assessment and alternative evaluation. A review of 54 impact assessment methodologies revealed that none entirely satisfied the needs or requirements for the Corps' water resources projects and programs. However, salient features contained in

several of the methodologies were considered pertinent for inclusion in WRAM. One of the features consisted of weighting impacted variables and scaling the impact of alternatives. The resulting weighted and scaled values are multiplied to obtain final importance values. The weighted rankings technique is the basic weighting and scaling tool used in this methodology. It consists of developing relative importance coefficient values for each variable, assigning alternative choice coefficient values to each alternative in relation to its impact on each variable, and displaying the products in a final coefficient matrix. (WES)
W77-09985

POTENTIAL ENVIRONMENTAL CONSEQUENCES OF TERTIARY OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W77-10023

IDENTIFICATION AND ANALYSIS OF MID-ATLANTIC ONSHORE OCS IMPACTS.
Resource Planning Associates, Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W77-10027

REPORT ON A BIOLOGIC AND SEDIMENTOLOGIC STUDY RELATED TO THE TYBEE ISLAND BEACH NOURISHMENT PROJECT AND THE OFFSHORE AREA FOR DREDGE MATERIAL DISPOSAL.
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 2L.
W77-10029

THE CASE FOR THE EXPANDED STUDY OF FRESHWATER POLLUTION ZOOLOGY,
Zululand Univ., Empangeni (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-10086

A CHECK LIST AND NOTES ON THE BIRDS OF SANDVICS, SOUTH WEST AFRICA,
South African Div. of Nature Conservation and Tourism, Etosha. Ecological Inst.
For primary bibliographic entry see Field 2L.
W77-10089

ENVIRONMENTAL SCIENCES.
Council for Scientific and Industrial Research, Pretoria (South Africa).
S. Jackson.
Scientiae, Vol. 16, No. 4, p 8-15, August 1975. 12 fig.

Descriptors: *Ecosystems, *Water pollution, Aquatic weeds, *Environmental effects, Management, Climatology, Primary productivity, Air pollution, Reservoir silting, Irrigation, Photosynthesis, Africa, *Ecology.
Identifiers: Nylsvley, Pongola River, Lake Sibaya, Wilderness lakes, South Africa.

The South African National Committee on Environmental Sciences has confined the scope of its activities to man's natural environment. Attention is focussed on the working of the environment considered as a living system in which man finds a place; on problems of its management; on preserving vegetation types; and preventing environmental deterioration. Two ecological systems were chosen for special study because of their applicability to other systems. The first study is of a savanna system in the Nylsvley reserve between Naboomspruit and Potgietersrus, in the Transvaal. A fundamental examination of the savanna region bordering the southern tropic has been undertaken. This involves studying the energy cycle through the system. A multi-disciplinary study has been planned to establish how the ecosystem

works and what stresses are imposed by man's presence. Later it is hoped to point out how stress on the system can be avoided by better management, and what the human occupation capacity of the area is. Other projects of the National environmental program include inland waters, coastal lakes, air pollution, inversion climatology, and heat islands over large cities. (So. African Water Info. Center)
W77-10098

LAKE SIBAYA - A LAND-LOCKED ESTUARY,
Rhodes Univ., Grahamstown (South Africa) Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-10099

7. RESOURCES DATA

7A. Network Design

ELEMENTS NEEDED IN DESIGN OF A GROUND-WATER-QUALITY MONITORING NETWORK IN THE HAWAIIAN ISLANDS,
Geological Survey, Honolulu, Hawaii. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-09995

FEDERAL PLAN FOR ACQUISITION OF WATER DATA BY FEDERAL AGENCIES, FISCAL YEAR 1977.
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-10013

7B. Data Acquisition

AN AUTOMATIC SCANNING APPARATUS FOR GAMMA SPECTROMETRY FOR THE DETERMINATION OF THE MOISTURE CONTENT IN SOIL COLUMNS, (IN DUTCH),
For primary bibliographic entry see Field 2G.
W77-09613

A PRACTICAL APPARATUS FOR QUANTITATIVE SAMPLING OF EPIPLITHIC PERIPHYTON, (IN FRENCH),
Liege Univ. (Belgium). Dept. of Botany.
J. P. Descy.
Bull Soc R Bot Belg 199(1), p 43-47, 1976.

Descriptors: Sampling, Equipment, Periphyton, Diatoms, Rivers, Instrumentation.
Identifiers: *Belgium, *Epilithic periphyton, River Meuse (Belgium).

An apparatus, derived from the original one of Douglas, was designed for the sampling of epilithic periphyton, without losses, from a known area. A study of the variability of sampling, for diatoms, was made in 1 station of the Belgian part of the river Meuse.--Copyright 1977, Biological Abstracts, Inc.
W77-09623

DETERMINATION OF HYDRAULIC PARAMETERS TO ESTIMATE WATER MOVEMENT AND WATER STORAGE IN UNDISTURBED SOIL: COMPARISON OF FIELD AND LABORATORY METHODS, (IN GERMAN),
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-09624

A METHODOLOGY FOR COMPARATIVE EVALUATION OF WATER QUALITY INDICES,
Worcester Polytechnic Inst., Washington, D. C. Project Center.
For primary bibliographic entry see Field 5A.
W77-09632

CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W77-09634

CATION-EXCHANGE CAPACITY OF ACID SOILS USING ALUMINUM CHLORIDE AND BARIUM CHLORIDE-TRIETHANOLAMINE,
Klamath National Forest Yreka, Calif.
For primary bibliographic entry see Field 2G.
W77-09652

TEMPORALLY AND AREALLY DISTRIBUTED RAINFALL,
Agricultural Research Service, Athens, Ga. Southeast Watershed Lab.
For primary bibliographic entry see Field 2B.
W77-09696

EXPERIENCES WITH THE USE OF THE AEROLOGICAL METHOD IN EVAPORATION STUDIES IN NORTHWESTERN EUROPE,
Helsinki Univ. (Finland). Dept. of Meteorology.
For primary bibliographic entry see Field 2D.
W77-09710

A MODEL OF TRANSPIRATION AND INTERCEPTION LOSS FROM A SPRUCE FOREST IN PLYNLIMON, CENTRAL WALES,
Institute of Hydrology, Oxon (England).
For primary bibliographic entry see Field 2D.
W77-09711

A LABORATORY MODEL TO INVESTIGATE THE SOIL MOISTURE CONDITIONS ON A DRAINING SLOPE,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W77-09712

A SIMPLE HAND CORER FOR SHALLOW WATER SAMPLING,
Southwest Research Inst., Houston, Tex.
J. H. Baker, L. A. Pugh, III, and K. T. Kimball.
Chesapeake Science, Vol 18, No 2, p 232-236, June 1977. 3 fig, 2 tab, 15 ref.

Descriptors: *Sampling, *Cores, *Equipment, *Sediments, Shallow water, Estuaries, Benthos, Benthic fauna, Benthic flora, Pesticides, Heavy metals, Oil, Sand, Mud, Silts, Monitoring, Sedimentology.
Identifiers: *Sediment corers.

A simple, inexpensive 2 in Hand Corer was developed for efficiently sampling most types of shallow water sediments. The corer consists of a Lexan plastic core tube, 1-1/2 in -check valve unit, and polyvinyl chloride tube handle. The 2 in Hand Corer consistently collected higher mean densities of organisms than did the Mackin Corer, resulting in more precise estimates of the mean densities of the collected taxa. Undisturbed sediment samples for pesticide, oil and grease, and heavy metals analysis also were collected. (Sims-ISWS)
W77-09715

STANDARDIZATION OF METHYLMERCURY ANALYSIS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5A.

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

W77-09775

ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSES: ASSISTANCE PROJECTS, FY 75,
Environmental Research Lab., Athens, Ga.
Analytical Chemistry Branch.
For primary bibliographic entry see Field 5A.
W77-09782

OCEANOGRAPHIC WATER SAMPLER,
E. Ratigan.
U.S. Patent No. 4,002,066, 6 p, 5 fig, 4 ref; Official Gazette of the

Descriptors: *Patents, Oceanography, *Sampling, *Water sampling, On-site-data collections, On-site tests, Time series analysis.
Identifiers: *Oceanographic water samplers.

In order to solve the difficulty of a relatively long time delay before a test can be made on an oceanographic water sample, this invention permits adding reagents, in situ, at the time and place where the sample is taken before any change in oxygen contents can be made by change of temperature or handling of the sample. A container has a pair of covers which can be closed. Means are provided to add chemicals to the trapped water in the container at the same location where and when the sample is taken. Ampules containing the chemical are mounted in the container and knives are connected to break the ampules at predetermined times. A time delay device is provided so that a first chemical may be added to the trapped water at a certain time, and the second chemical may be added to the trapped water after a predetermined time delay. (Sinha-OEIS)
W77-09799

ACOUSTICAL WAVE FLOWMETER,
Institutes of Medical Sciences, San Francisco, Calif. (Assignee).
E. J. Dewath.
U.S. Patent No. 4,003,252, 9 p, 6 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 954, no 3, p 1011, January 18, 1977.

Descriptors: *Patents, *Flowmeters, *Instrumentation, Velocity, Flow measurement, Acoustics, Sound waves.
Identifiers: Transducers.

The invention comprises an acoustical wave flowmeter in which the transmitting and receiving transducers are mounted in the fluid flow conduit in such a manner as to provide a smooth walled flow conduit having no substantial protuberances into the fluid flow path or cavities. A housing having rigid walls is provided with an inner liner of acoustic damping material in which four transducers are mounted, the inner surfaces of the transducers having substantially the same shape and dimensions as the inner wall surface of the liner of acoustic damping material. Two transducers are spaced a fixed distance and are operated exclusively in a receive mode; while the two outer transducers are operated exclusively in a transmit mode. In operation, the outer transmit transducers are alternately energized to generate compressional waves which travel from the transmitting transducer to the receiving pair in the upstream and downstream directions, respectively. By measuring the phase difference between waves traveling in the upstream and downstream directions and received by the receiving transducer pair, the velocity of fluid flow in the conduit is readily determined. (Sinha-OEIS)
W77-09809

AN EVALUATION OF TOTAL SOLAR REFLECTANCE AND SPECTRAL BAND

RATIOING TECHNIQUES FOR ESTIMATING SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz.
Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W77-09957

THE GREAT DISMAL SWAMP: MANAGEMENT OF A HYDROLOGIC RESOURCE WITH THE AID OF REMOTE SENSING,
Geological Survey, Reston, Va. Water Resources Div.; and Great Dismal Swamp National Wildlife Refuge, Suffolk, Va.; and National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 2H.
W77-10007

WATER COLOR AND CIRCULATION SOUTHERN CHESAPEAKE BAY. PART I. SOUTHERN CHESAPEAKE BAY WATER COLOR AND CIRCULATION ANALYSIS, PART II. SKYLAB MSS VS. PHOTOGRAPHY FOR ESTUARINE WATER COLOR CLASSIFICATION,
Virginia Inst. of Marine Science, Gloucester Point.
Applied Marine Science and Ocean Engineering.
For primary bibliographic entry see Field 2L.
W77-10026

UNDERWATER HABITATS FOR SCIENTIFIC RESEARCH IN THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
L. H. Somers, and R. F. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 662. Price codes: A02 in paper copy, A01 in microfiche. In: Proceedings 13th Conference of Great Lakes Research, p 1041-1049, 1970. 2 fig, 5 ref. (Univ. of Michigan Great Lakes Research Div. Contribution No. 142). NSF GA-4507, GA-352 and SG GH-50.

Descriptors: *Underwater, *Bathymetry, *Caissions, *Watertight, *Equipment, On-site investigations, Anchors, *Great Lakes, Diving, Nutrient requirements, Benthic flora, Spatial distribution, Diurnal.
Identifiers: *Underwater habitats(Subliminos), *Diving equipment, Underwater mapping.

Description is given of the use of a small, inexpensive shallow-water underwater habitat, Subliminos, which rests at a depth of 30 ft. in Little Dunks Bay on the Bruce Peninsula in Georgian Bay, Ontario. This habitat, a vertically-oriented cylinder 9 ft. high and 8 ft. in diameter, provides about 350 cu. ft. of living space and is designed to serve as a shallow-water 'explorer's tent' to increase an observer's daily underwater time during the 2 years it is designed to remain in place. The steel personnel chamber is anchored by a lower cylinder which contains about 10 tons of ballast. Underwater operations for which Subliminos have been used include a nutrient enrichment experiment with phytoplankton populations, in-situ measurements of production rates of benthic algae, a study of the spatial distribution of macrobenthic invertebrates, a time study of the behavior and ecological relationships of certain populations which variations between day and night periods, and an evaluation of two methods of underwater mapping which proved applicable to areas of moderate-to-good subsurface visibility. The Subliminos habitat, while limited in depth, duration of use and comfort, costs only \$10,000-\$30,000 to build and can be operated on an annual budget of \$40,000-\$50,000. (Harris-Wisconsin)
W77-10060

7C. Evaluation, Processing and Publication

A FOOD WEB MODEL FOR LAKE MICHIGAN: PART I—JUSTIFICATION AND DEVELOPMENT OF THE MODEL,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W77-09631

AN ELECTRIC ANALOG AND DIGITAL COMPUTER MODEL OF THE CHIPUXET GROUND WATER AQUIFER, KINGSTON, RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W77-09637

PRECIPITATION TREND AND STORM ANALYSIS IN COLORADO.
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 2C.
W77-09685

SATELLITE-DERIVED GLOBAL OCEANIC RAINFALL ATLAS (1973 AND 1974),
National Aeronautics and Space Administration, Greenbelt, Goddard Space Flight Center.
M. S. V. Rao, W. V. Abbott, III, and J. S. Theon.
Available from the Supt. of Documents, GPO, Washington, DC 20402, Catalog No. C/N NASI. 21-410. NASA SP-410, June 1976. 181 p, 14 fig, 2 ref, 5 append.

Descriptors: *Atlantic Ocean, *Pacific Ocean, *Rainfall, *Indian Ocean, *Maps, *Data collections, Monthly, Seasonal, Annual, Oceans, Remote sensing, Distribution patterns, Rainfall intensity, Rates, Precipitation(Atmospheric), Spatial distribution, Satellites(Artificial).
Identifiers: *Rainfall maps, Rainfall patterns, *Oceanic rainfall atlas.

Based on the relationship between satellite-borne Electrically Scanning Microwave Radiometer brightness temperatures and rain-rates over oceans, quantitative maps of rainfall were obtained from Nimbus-5 microwave data. Weekly, monthly, seasonally, and annually averaged maps were generated from December 1972 through February 1975. From the maps, analysis was made of the patterns of rainfall in the three major oceanic areas of the world; namely, the Pacific, Atlantic, and Indian Oceans. It was shown that the data permit the monitoring of features such as the movement of the Intertropical Convergence Zone and the advance of the Indian Monsoon. An interesting rainfall pattern in the Pacific, associated with the El Nino phenomenon, was revealed. A possible interpretation of the pattern in terms of a local variation of the Hadley cell circulation was discussed. The variations in oceanic rainfall and in latent heat release (which has also been computed) should provide useful inputs to numerical models and to studies of planetary energy and water budgets. (Froehlich-ISWS)
W77-09693

COMPUTER INTERPRETATION OF POLLUTANT MASS SPECTRA,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 5A.
W77-09776

COMPUTER APPLICATION IN WATER AND WASTE WATER MANAGEMENT: A PANEL DISCUSSION,
Houston Univ., Tex. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.

W77-09903

WATER SUPPLY FROM SHELBYVILLE AND CARLYLE LAKES AND THEIR OPTIMAL JOINT OPERATION,

Illinois State Water Survey, Urbana. Hydrology Section.
For primary bibliographic entry see Field 4A.
W77-09943

SENSITIVITY ANALYSIS OF THE WATER QUALITY FOR RIVER-RESERVOIR SYSTEMS MODEL,

Army Engineer V aterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-09981

THE COCKFIELD AQUIFER IN MISSISSIPPI,

Geological Survey, Jackson, Miss. Water Resources Div.
C. A. Spiers.
Water-Resources Investigations 77-17 (open-file report), April 1977. 3 sheets, 17 fig, 3 tab, 14 ref.

Descriptors: *Groundwater resources, *Mississippi, *Aquifer characteristics, *Water supply, *Water quality, Well data, Water users, Pumping, Water yield, Specific capacity, Drawdown, Water wells, Hydrologic data, Hydrogeology, Mapping.
Identifiers: *Cockfield Formation(Miss), Eocene aquifers, Claiborne Group.

The Cockfield Formation in the upper part of the Claiborne Group of Eocene age is a principal source of water supplies in Mississippi. The Cockfield Formation consists of beds of fine to medium sand, sandy carbonaceous clay, and thin beds of lignite. The largest withdrawal from the aquifer is in the Greenville-Leland area in Washington County where about 7.3 mgd was pumped in 1975. Long-term water-level trends indicate an average decline of about 1.5 ft per year. Specific capacity of wells in the Cockfield ranges from about 1.6 to 4.3 (gal/min)/ft. The dissolved-solids concentration in the water increases downip to the west and the south. The Cockfield aquifer will continue to be major source of water supply in Mississippi and well fields producing 1 to 3 mgd can be developed in many places.
(Woodard-USGS)
W77-09991

COMPUTATION OF UNSTEADY FLOWS IN RIVERS AND ESTUARIES BY THE METHOD OF CHARACTERISTICS,

Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-09993

DISCHARGE DATA AT WATER-QUALITY MONITORING STATIONS IN ARKANSAS, 1976 WATER YEAR,

Geological Survey, Little Rock, Ark. Water Resources Div.
R. K. Knott.
Open-file report 77-401, May 1977. 16 p, 2 tab.

Descriptors: *Streamflow, *Discharge measurement, *Flow rates, *Arkansas, Water quality, *Data collections, Sites, Basic data collections.

Streamflow data are presented for a network of water-quality monitoring stations operated by the Arkansas Department of Pollution Control and Ecology. Discharge on days of sampling was determined for about 75 of the sites. A summary of those discharges for the water year 1976 is tabulated. Several discharges for miscellaneous dates in the 1974 and 1975 water years are shown also.
(Woodard-USGS)
W77-09997

SELECTED WATER-LEVEL RECORDS FOR WESTERN OKLAHOMA, 1975-1976,

Geological Survey, Oklahoma City, Okla. Water Resources Div.
R. L. Goemaat.
Open-file report 77-239, 1977. 50 p, 1 fig, 1 tab.

Descriptors: *Groundwater resources, *Water levels, *Water wells, *Irrigation, *Oklahoma, Basic data collections, Sites, Observation wells, Water level fluctuation, Aquifers.
Identifiers: Western Oklahoma.

Ground-water-level measurements and water level changes are tabulated for about 860 wells in 25 counties of western Oklahoma where ground water is heavily used for irrigation. Measurements were made in major aquifers of the area including the Ogallala Formation, Rush Springs Sandstone, Blaine Gypsum, Cimarron terrace, and Tillman terrace. The data are subdivided by counties.
(Woodard-USGS)
W77-09998

GROUND-WATER LEVELS IN OBSERVATION WELLS IN OKLAHOMA, 1975,

Geological Survey, Oklahoma City, Okla. Water Resources Div.
R. L. Goemaat.
Open-file report 77-238, 1977. 35 p, 1 fig, 1 tab.

Descriptors: *Groundwater resources, *Water levels, *Basic data collections, *Oklahoma, Observation wells, Sites, Aquifers, Water level fluctuations, Water supply.

Ground-water-level measurements made in 42 observation wells throughout Oklahoma are tabulated for the calendar year 1975. The data are subdivided by counties. The objectives of the observation-well program are (1) to provide long-term records of water-level fluctuations in representative wells, (2) to facilitate the prediction of water-level trends and indicate the future availability of ground-water supplies, and (3) to provide information for use in basic research. (Woodard-USGS)
W77-09999

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 1. OHIO RIVER BASIN,

Geological Survey, Columbus, Ohio. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 782. Price codes: A24 in paper copy, A01 in microfiche. Water-Data Report OH-75-1, 1976. 578 p, 1 fig, 4 tab, 33 ref.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Water resources, Gaging stations, Streamflow, Flow rates, Water wells, Water levels, Lakes, Reservoirs, Sampling, Sites, Water analysis, Chemical analysis, Sediments.

Water resources data for the 1975 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge records for 238 gaging stations; stage and contents for 32 lakes and reservoirs; water quality for 174 gaging stations, and 12 wells; and water levels for 25 observation wells. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (Woodard-USGS)
W77-10000

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1975—VOLUME 2. ST. LAWRENCE RIVER BASIN,

Geological Survey, Columbus, Ohio. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 783. Price codes: A11 in paper copy, A01 in microfiche. Water-Data Report OH-75-2, 1976. 258 p, 1 fig, 4 tab, 33 ref.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Water resources, Water temperature, Gaging stations, Streamflow, Flow rates, Water wells, Water levels, Lakes, Reservoirs, Sampling, Sites, Water analysis, Chemical analysis, Sediments.
Identifiers: *St. Lawrence River basin(Ohio).

Water resources data for the 1975 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report for the St. Lawrence River basin, contains discharge records for 59 stations; water quality for 50 stations, and 3 wells; and water levels for 8 observation wells. Additional water data were collected at various sites, not part of the systematic data collection program, and are published in separate tables. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other governmental agencies in Ohio. (Woodard-USGS)
W77-10001

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1975,

Geological Survey, Cheyenne, Wyo. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 841. Price codes: A99 in paper copy, A01 in microfiche. Water-Data Report WY-75-1, October 1976. 646 p, 5 fig, 4 tab, 40 ref.

Descriptors: *Wyoming, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Water resources, Gaging stations, Streamflow, Flow rates, Water wells, Water levels, Lakes, Reservoirs, Sampling, Sites, Water analysis, Chemical analysis, Sediments.

Water resources data for the 1975 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 215 gaging stations; stage only records for 1 lake; stage and contents for 16 lakes and reservoirs; water quality for 126 gaging stations, 6 partial-record flow stations, 4 lakes, and 188 wells; and water levels for 48 observation wells. Also included are 114 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (Woodard-USGS)
W77-10002

ANNUAL WATER-RESOURCES REVIEW WHITE SANDS MISSILE RANGE, 1976 - A BASIC-DATA REPORT,

Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-10005

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

WATER QUALITY PROGRAM OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10006

FEDERAL PLAN FOR ACQUISITION OF WATER DATA BY FEDERAL AGENCIES, FISCAL YEAR 1977.
Geological Survey, Reston, Va. Water Resources Div.
Office of Water Data Coordination report, December 1976. 86 p, 2 fig, 8 tab, 3 append.

Descriptors: *Hydrologic data, *Data collections, *Networks, *Projects, *United States, Data storage and retrieval, Federal government, Governmental interrelations, Regional analysis. Identifiers: *National Water Data Network.

The Federal Plan for the Acquisition of Water Data summarizes the activities planned for fiscal year (FY) 1977 by Federal agencies concerned with the acquisition and use of water data. The Federal Plan is prepared each year by the Geological Survey's Office of Water Data Coordination (OWDC) in compliance with Office of Management and Budget (OMB) Circular A-67 which states: "...the Department of the Interior will prepare and keep a Federal Plan, and the status of its implementation, for the efficient utilization of network and related specialized water-data acquisition activities." Compilation is based principally on "Regional Plans" prepared for each of the 21 water resources regions. The scope for reporting on station activities includes long-term (3 or more years of continuous operation) ground-water quality stations and stage, discharge, and water-quality stations on surface water bodies. The practice, which began in the FY 1976 field coordination cycle, of including information on both long-term and short-term (less than 3 years continuous operation) surface-water station activities of the Geological Survey was continued through the FY 1977 cycle, and this information also is included in this report. (Woodard-USGS)
W77-10013

FLUCTUATIONS OF GROUND-WATER LEVELS IN LEE COUNTY, FLORIDA, IN 1975 WATER YEAR,
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-10014

1976 WATER-QUALITY DATA IN BEAR CREEK BASIN, MEDFORD, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-10015

A DYNAMIC WATER QUALITY MODEL FOR THE NEUSE ESTUARY, N.C.,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-10037

METHOD OF ANALYZING SOME EXPERIMENTAL DATA ON ZOOPLANKTON, (IN RUSSIAN),
Biologo-Geograficheskii Nauchno-Issledovatel'skii Institut, Irkutsk (USSR).
For primary bibliographic entry see Field 2I.
W77-10038

8. ENGINEERING WORKS

8A. Structures

THROUGH THE ANDES.
South African Tunneling, Vol 1, No 3, p 4-5, 1976.

Descriptors: Irrigation design, *Tunnel construction, *Dam construction, Reservoir construction, *South America, Irrigation engineering, *Irrigation systems, *Tunnel design, Flumes, Diversion structures.
Identifiers: South Africa, *Peru(Majes irrigation scheme), Andes mountains.

Concor Construction has been allocated the task of building eight tunnels totalling 11 km in length as part of the massive Majes irrigation scheme project in Peru. It is working on the project in conjunction with companies from Canada, England, Spain and Sweden. Described are the South African company's share in the project, the design and construction of a factory for the manufacture of precast flumes and the construction of a reservoir and dam at Condoroma which will control the Colca River. (So. African Water Info Center).
W77-09687

TUNNELLING WORK FOR THE RUACANA SCHEME.
E. P. Chunnnett.
South African Tunneling, Vol 1, No 4, p 6-13, 1976.

Descriptors: Rock excavation, Tunnel construction, Shafts, Hydroelectric plants, Rock mechanics, Africa.
Identifiers: *Ruacana scheme(SWA), Cunene River, *South West Africa.

Underground excavations totalling nearly 370 000 m³ were needed for the various tunnels, caverns, shafts, special galleries and construction adits for the hydropower station at Ruacana. In addition surface excavations for portals and the large surge headbay amounted to almost 300 000 m³, apart from a further 120 000 m³ involved in foundations for the diversion weir. Other than the lower heading for the tailrace tunnel, all excavations have been completed. Described the scheme being undertaken by the SWA Water and Electricity Corporation with the objective of generating hydropower with an annual output of some 1 200 GWh which will be transmitted into the SWA grid. (So. African Water Info Center).
W77-09688

DURBAN TUNNELS UNDER THE MICROSCOPE,
Durban City Engineers Dept. (South Africa).
D. C. MacLeod.
South African Tunneling, Vol 1, No 3, p 23-28, 1976. 2 tabs.

Descriptors: Tunnel design, Tunnel construction, Drainage engineering, Sewers, Africa.
Identifiers: Durban(South Africa).

The important role played by tunnels in the past and future development of Durban is underlined in this article written by the City's Engineer. Tunnels will be used to an even greater extent in meeting the anticipated engineering requirements of the city. A description is given of the tunnels that have been constructed and are being planned for the supply of raw water for water purification works as well as for drainage and sewerage purposes. (So. African Water Info Center).
W77-09689

A UNIQUE MEANS OF OBTAINING SEA-WATER,
South West African Consolidated Diamond Mines Ltd., Oranjemund.

For primary bibliographic entry see Field 8E.
W77-09692

PENNSYLVANIA WASTE WATER PROJECT PROGRESSES QUICKLY.
For primary bibliographic entry see Field 5D.
W77-09840

CITY OF MINNETONKA WING LAKE TRUNK SEWER: CITY OF MINNETONKA, MINNESOTA.
For primary bibliographic entry see Field 5D.
W77-09842

NEW SEWER SYSTEM RESISTS INFILTRATION.
For primary bibliographic entry see Field 5D.
W77-09843

SAFFRON WALDEN OPENS ITS LOW PROFILE SEWAGE WORKS,
For primary bibliographic entry see Field 5D.
W77-09872

CONSTRUCTION MANAGEMENT FOR WASTE WATERTREATMENT PLANTS,
CM Associates, Inc., Houston, Tex.
For primary bibliographic entry see Field 5D.
W77-09920

WATER RESOURCES ASSESSMENT METHODOLOGY (WRAM)—IMPACT ASSESSMENT AND ALTERNATIVE EVALUATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 6G.
W77-09985

MAKING SURE OF PIPELINE PERFORMANCE,
Construction in Southern Africa, Vol. 21, No. 3, p 53-57, June 1976. Illustrated.

Descriptors: *Pipelines, *Performance, Sewers, Drains, *Instrumentation, Africa.
Identifiers: *South Africa.

In the wake of new recommendations for the air testing of sewers and drains by the Council for Scientific and Industrial Research's National Building Research Institute, a South African company has designed what is claimed to be a reliable and simple unit to carry out these important checks. Due to the unavailability of a versatile and economic method of testing, several municipalities have admitted that their checking methods have not been as comprehensive as they would like. (So. African Water Info Ctr)
W77-10068

THE DAM BUSTERS,
Construction in Southern Africa, Vol. 20, No. 12, p 39-47, March 1976. 4 fig.

Descriptors: Disasters, *Dam failure, Dam sites, Damage control, Damage criteria, Africa, *Foundation failure.
Identifiers: Bouzey Dam, Marshall Creek Dam, Dokan Dam, Dolgarrog Dam, *South Africa.

Most structural failures result in fairly localized damage. The failure of a dam is something else again, for thousands of tons of unrestrained water can leave a wake of destruction that includes farmlands, industries and wholesale loss of life, both human and animal. Some of the world's dam failures are described. (So. African Water Info Ctr)
W77-10070

CAPE TOWN'S STEENBRAS HYDRO-ELECTRIC PUMPED STORAGE SCHEME,
Siemens (Pty) Ltd., Cape Town (South Africa).
G. K. Maier.
Vector, No. 4, p 24-40, April 1976. 3 fig.

Descriptors: Pumped storage, Hydro-electric plants, Dam design, Tunnel design, Hydraulic aspects.
Identifiers: Steenbras dam, South Africa.

The Steenbras hydro-electric pumped storage scheme will utilize cheap off-peak power available at night to pump water from a lower reservoir to an upper mountain reservoir in order to utilize the energy thus stored to generate power to meet the peak demand during day-time hours. Thus, the Cape Town Municipality will have at its doorstep a 180 MW supply plant which should be adequate to cater for the city's requirements for many years to come. Details regarding the dams, machine sites, power house and tunnels are given. (So. African Water Info Ctr)
W77-10071

THE DAY THEY ALMOST ABANDONED THE ORANGE-FISH TUNNEL,
H. Olivier.
Construction in Southern Africa, Vol 20, No 10, p 41-43, January 1976. 2 illus.

Descriptors: *Tunnel construction, Legal aspects, *Costs.
Identifiers: *Orange-Fish Tunnel(South Africa).

So enormous was the cost escalation during the construction of the Orange-Fish tunnel that one of the contractors was forced to issue summons on the South African Minister of Water Affairs while the other consortia involved recommended abandoning the project. These facts are revealed in a book released by the author, who is a former chairman of LTA and probably the world's leading expert on major dam design. (So. African Water Info Ctr)
W77-10077

8B. Hydraulics

THROUGH THE ANDES.
For primary bibliographic entry see Field 8A.
W77-09687

BRINK DEPTH METHOD IN RECTANGULAR CHANNEL,
Agricultural Univ., Wageningen (Netherlands).
Dept. of Hydrology and Catchment Hydrology.
D. A. Kraijenhoff, and A. Dommerholt.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 103, No. IR2, Proceedings Paper 12971, p 171-177, June 1977. 5 fig, 11 ref, 1 append.

Descriptors: *Critical flow, *Channels, *Roughness(Hydraulic), Open channel flow, Open channels, Reynolds number, Mathematical studies, Roughness coefficient slopes, Subcritical flow, Channel flow, Hydraulics.
Identifiers: *Critical depth, Rectangular channels, Brink depth method.

Supplementary experiments for the brink depth method in a rectangular channel were described, including changes of channel slope and channel roughness. The ratio of the end depth and the critical depth as suggested by Rouse, was confirmed for Reynolds numbers ranging from 20,000 to 1,000,000. (Lee-ISWS)
W77-09695

SHALLOW MARINE SAND BAR SEQUENCES: AN EXAMPLE FROM THE LATE PRECAMBRIAN OF NORTH NORWAY,
Oxford Univ. (England). Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 2J.
W77-09699

DESIGN AND OPERATION OF RAIN SPILLWAYS AND RAIN OVERFLOW CATCHMENT (ENTWURF UND BETRIEB VON REGENBERLAUFEN (RU) UND REGENBERLAUFBECKEN (RUB)),
S. Pfeiff.
Berichte der Abwassertechnischen Vereinigung e.V., No. 29, p 127-146, 1976. 11 fig.

Descriptors: *Storm runoff, *Watersheds(Basins), *Spillways, *Design criteria, *Operations, Overflow, Canal construction, Precipitation(Atmospheric), Water storage, Dam construction.

Detailed description is given of the design and operation of rain spillways and rain overflow catchment basins. Feed canals should have triangular or half-cup cross-sections to prevent sludge sedimentation from back-water. The overflow dam should be at least 25 cm above the feed canal sole, and it should be as long as possible. (Takacs-FIRL)
W77-09822

CRITICAL AND BRINK DEPTHS IN ELLIPTICAL SEWERS,
A. S. Paintal.
Water and Sewage Works, Reference Issue, p 172-173, April, 1977. 3 fig.

Descriptors: *Sewers, *Non-uniform flow, *Channel flow, *Flow rates, Subcritical flow, Overfalls, Physical properties, Conveyance structures, Mathematical studies, Equations.
Identifiers: Critical depth, Brink depth, *Elliptical sewers.

A method for the determination of critical depth in elliptical sewers was presented. Flow estimation involved measurement of brink depth. Brink depth was the result of a subcritical sewer flow at a free overfall critical depth upstream of the overfall. The brink depth to critical depth ratio is constant and provides a method for critical depth determination. Basic elliptical geometry was combined with mathematical expressions for the determination of critical depth and brink depth. This resulted in equations which could be used to formulate functional relationships between the two depths. (Collins-FIRL)
W77-09841

BUOYANT SURFACE JETS DISCHARGED INTO A STRONG CROSSFLOW,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-09926

ENTRAINMENT VELOCITY IN NATURAL STRATIFIED VERTICAL SHEAR FLOW,
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
For primary bibliographic entry see Field 2L.
W77-09946

SENSITIVITY ANALYSIS OF THE WATER QUALITY FOR RIVER-RESERVOIR SYSTEMS MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-09981

HYDRAULICS AND DYNAMICS OF NEW CORPUS CHRISTI PASS, TEXAS: A CASE HISTORY, 1973-75,
Texas Univ. at Austin. Port Aransas. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W77-09982

STABILITY OF RUBBLE-MOUND BREAKWATER JUBAIL HARBOR, SAUDI ARABIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. D. Carver, and D. D. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 815. Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-76-20, December 1976. 71 p, 4 fig, 1 tab, 6 ref, 41 photo, 9 pl.

Descriptors: *Hydraulic models, *Breakwaters, *Harbors, Model studies, Asia.
Identifiers: *Jubail Harbor(Saudi Arabia), *Rubble-mound breakwaters.

An undistorted-scale hydraulic model study was conducted to investigate the adequacy of seven breakwater cross sections considered for use at Jubail Harbor, Saudi Arabia. Tests conducted in evaluating the various plans consisted of (1) two-dimensional stability tests (Plans 1, 2, 2A, 3, 4, and 5), (2) two-dimensional transmission tests (Plans 1, 2, 3, and 5), and (3) three-dimensional stability tests (Plan 6). Test results indicate that for the selected design conditions 5.0-metric-ton dolos armor will be of adequate size for use on all portions of the Jubail breakwater system. (WES)
W77-09984

SEASONAL VARIATIONS IN GREAT LAKES DESIGN WAVE HEIGHTS: LAKE ERIE,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
D. T. Resio, R. M. Brooks, and C. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A039 153. Price codes: A05 in paper copy, A01 in microfiche. Miscellaneous Paper H-76-21, March 1977. 82 p, 8 fig, 1 tab, 12 ref, 4 append.

Descriptors: *Great Lakes, *Lake Erie, *Waves(Water), *Seasonal, Methodology, Climatology.
Identifiers: *Design wave heights.

Tables of 5-day extremal parameters are presented, along with a methodology for the calculation of design wave heights for variable intervals of time during the year. A brief description of the Great Lakes climatology is included to provide a meteorological context for the wave height variations throughout the year. (WES)
W77-09986

DICKEY-LINCOLN SCHOOL LAKES HYDROTHERMAL MODEL STUDY; HYDRAULIC LABORATORY INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
M. S. Dorch, B. Loftis, D. G. Fontane, and S. C. Wilhelms.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 538. Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-76-22, December 1976. 72 p, 14 fig, 1 tab, 14 ref, 2 append, 15 pl.

Descriptors: *Hydraulic models, *Mathematical models, *Pumped storage, *Reservoirs, *Stratified flow, *Thermal stratification, *Water temperature, *Maine, Lakes.
Identifiers: *Dickey-Lincoln School Lakes(Me).

A one-dimensional, vertically stratified thermal simulation model was developed for prediction of

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

temperature within and downstream from Dickey-Lincoln School Lakes. Two physical hydraulic models were used to obtain an improved understanding and description of the hydrodynamic response of the lakes to pumped-storage hydropower. An undistorted, 1:200-scale model of the Dickey Lake intake structures and local topography was used to determine the steady-state selective withdrawal and pumpback flow characteristics for various conditions. A highly distorted-scale model (1:3600 horizontal, 1:180 vertical) was used to simulate the entire dual reservoir system and to determine the response to dynamic, unsteady-state, density stratified flow. Information from the two physical models was used to modify existing algorithms and to develop new algorithms for the mathematical model. The mathematical model allows simulation of the hydrodynamic and heat exchange characteristics so that the thermal regimes within and downstream from the two lakes can be determined for various hydrologic and meteorologic conditions and various pumped-storage hydropower operations. (WES) W77-09987

LAKE DARDANELLE, ARKANSAS RIVER; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. E. Foster, and J. J. Franco.
Technical Report H-77-4, March 1977. 50 p, 2 fig, 24 pl.

Descriptors: *Hydraulic models, *Channel improvement, Channels, *Arkansas, Model studies, Lakes, Reservoirs, *Navigation, *Navigable rivers, Hydraulic structures.
Identifiers: *Arkansas River, *Lake Dardanelle(Ark), *Navigation channels.

Lake Dardanelle is a 51-mile-long reservoir formed by Dardanelle Lock and Dam which is located at mile 205.5 on the Arkansas River. This study, using a movable-bed model, was conducted to determine the type and location of training and stabilization structures needed to develop a satisfactory navigation channel downstream of mile 238.4 and to provide a satisfactory channel approaching the navigation span of the proposed highway bridge at mile 234.9. Results of this investigation indicated that: A plan could be developed that would provide a satisfactory crossing toward the left bank and in the approaches to the proposed bridge. Navigation gaps could be used in the two closure dikes across the channel along the right bank during construction and development of the crossing. Some shoaling could be expected in the upstream approaches to the gaps and some scouring could be expected just downstream of the gaps. Development of a channel along the left bank upstream of the proposed bridge would reduce the tendency for erosion of the left bank in the upper portion of the band downstream of the bridge. (WES) W77-09988

DESIGN FOR SMALL-BOAT HARBOR IMPROVEMENTS, PORT WASHINGTON HARBOR, WISCONSIN; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. R. Bottin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 088. Price codes: A09 in paper copy, A01 in microfiche. Technical Report H-77-1, February 1977. 172 p, 5 fig, 19 tab, 47 photo, 13 ref, 2 append, 62 pl.

Descriptors: *Hydraulic models, *Harbors, Waves(Water), *Wisconsin, Design, Lake Michigan, Model studies.
Identifiers: *Port Washington Harbor(Wisc), *Channel deepening, Rubble-mound breakwaters, *Small boat basins(Design).

A 1:75-scale undistorted hydraulic model reproducing Port Washington Harbor, approximately 2600 ft of shoreline on each side of the harbor, and sufficient offshore area in Lake Michigan to permit generation of the required test waves was used to investigate the design of certain proposed improvements with respect to wave action. The proposed improvement plan consisted of (1) new rubble-mound breakwaters within the existing harbor aggregating about 1330 ft in length and arranged to form a protected harbor of approximately 13.5 acres; (2) a 10-ft-deep, 150-ft-wide entrance channel; (3) a 10-ft-deep anchorage-maneuvering area about 3.5 acres in extent; (4) an 8-ft-deep, 72-ft-wide launching ramp channel extending from the anchorage-maneuvering area to a launching ramp; (5) a 500-ft-long wave absorber adjacent to the existing north breakwater; and (6) safety railings on the new breakwaters. A 50-ft-long generator, a centrifugal pump and flow meter, and an Automated Data Acquisition and Control System were utilized in model operation. (WES) W77-09989

IGLOO WAVE ABSORBER TESTS FOR PORT WASHINGTON HARBOR, WISCONSIN; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. R. Bottin, Jr.
Available from the National Technical Information Service, Springfield, VA. 22161. Miscellaneous Paper H-76-22, November 1976. 25 p, 1 fig, 2 tab, 4 ref, 5 pl.

Descriptors: *Hydraulic models, *Harbors, *Breakwaters, Standing waves, Waves(Water), *Wisconsin, Model studies, Lake Michigan, Testing procedures.
Identifiers: *Port Washington Harbor(Wisc), *Igloo absorber tests.

Port Washington Harbor is exposed to waves generated by storms from northeast to south-southeast. Storm waves from these directions have caused damage to harbor facilities and boats and difficulties to ships and craft navigating the harbor entrance. Standing waves in the slip areas have reached heights of 12 ft. Anchorage in the outer harbor is not safe for small boats due to lack of adequate wave protection. Hence, the harbor is unsafe as a harbor-of-refuge. Hydraulic model tests were conducted to determine the effects of installation of Igloo wave absorber units in the harbor. Conclusions drawn from the results of these tests were that (a) Igloo wave absorber units placed in and around the slip areas will significantly reduce wave heights in the slips; (b) east and west breakwaters constructed of Igloo units without backing will not be stable; (c) a 500-ft-long Igloo structure adjacent to the north breakwater as an alternative to the east breakwater will not meet established wave-height criteria; and (d) a 200-ft-long Igloo east breakwater (with backing) will meet the established wave-height criteria. (WES) W77-09990

COMPUTATION OF RECORDS OF STREAM-FLOW AT CONTROL STRUCTURES, Geological Survey, Bay Saint Louis, Miss. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-10003

VARIATION OF WIDTH AND DISCHARGE FOR NATURAL HIGH-GRADIENT STREAM CHANNELS, Geological Survey, Lawrence, Kans. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-10009

LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY; REPORT 4, MODEL DESIGN, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
D. G. Outlaw, D. L. Durham, C. E. Chatham, and R. W. Whalin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A012 069. Price codes: A02 in paper copy, A01 in microfiche. Technical Report H-75-4, February 1977 (Report 4 of a series). 109 p, 31 fig, 4 tab, 25 pl, 32 ref, append.

Descriptors: *Harbors, *Hydraulic models, *California, Model studies.
Identifiers: *Harbor oscillations, *Long Beach Harbor(Cal).

Described is the design of the Los Angeles and Long Beach Harbors hydraulic model for investigation of harbor oscillation characteristics of the existing harbor and for evaluation of various proposed harbor modifications. The effects of wave refraction, diffraction, viscous friction, wave reflection, wave transmission through the harbor breakwaters, wave filters, and wave absorbers were considered. Wave generator design, automated model data acquisition and control, and model data analyses are also described. The model reproduces approximately 253 square miles of prototype area. Model wave record analyses include the capacity for determination of: (a) average, root mean square, and significant wave height and (b) average period. Procedures for Fourier analysis and least-squares harmonic analysis of the wave record are also available. The hydraulic model can be used in a predictive mode to evaluate various proposed modifications to optimize the modifications from both a cost and functional standpoint. (See also W77-02955 and W75-10664 and W76-11751) (WES) W77-10016

NORTH FORK LAKE SPILLWAY SAN GABRIEL RIVER, TEXAS; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
E. D. Rothwell.
Technical Report H-76-10, October 1976. 64 p, 9 fig, 8 tab, 11 photo, 13 pl.

Descriptors: *Hydraulic models, *Weirs, *Spillways, *Outlet works, *Texas, Model studies, Hydraulic structures.
Identifiers: *North Fork Lake Dam(Tex), *San Gabriel River(Tex).

The spillway for North Fork Lake Dam will consist of a 1000-ft-wide uncontrolled broad-crested weir excavated in limestone located in the right abutment of the dam. An outlet works consisting of two flood-control and four low-flow inlets will discharge into a hydraulic-jump-type stilling basin and exit channel located on the downstream side of the earth-filled dam. Model investigations were conducted using a 1:80-scale model to develop a design that would eliminate the destructive currents along the toe of the earthfill dam embankment and in the vicinity of the outlet works stilling basin and spillway discharge channel. The model was also used to measure velocities, surging, and flow patterns for several discharges in the approach and discharge channels and to determine the design of a rockfill dike at the upstream left abutment of the spillway. Tests indicated that a 100-ft-long elliptical-shaped dike would be required in the vicinity of the upstream left abutment to provide protection for the dam embankment and retaining wall. The minimum stone size ($d_{50} = 16$ in.) required for stability of the upstream rockfill dike was determined from the model. The hydraulic performance of the spillway crest design was satisfactory for a range of anticipated discharges. (WES) W77-10017

OLD RIVER EXISTING LOW-SILL CONTROL STRUCTURE, LOUISIANA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station,
Vicksburg, Miss.

E. D. Rothwell, and J. L. Grace, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 996, Price codes: A08 in paper copy, A01 in microfiche. Technical Report H-77-2, February 1977. 147 p, 10 fig, 27 tab, 12 photo, 71 pl.

Descriptors: *Hydraulic models, *Control structures, *Open channel flow, *Stilling basins, *Louisiana, Hydraulic structures, Model studies. Identifiers: *Old River Control Structure(La).

The Old River Existing Low-Sill Control Structure consists of eleven 44-ft-wide gate bays separated by piers. Model investigations were conducted using two 1:36-scale section models and a 1:150-scale section model to evaluate and develop a satisfactory means of regulating the existing structure to achieve the desired flow objectives without creating adverse hydraulic flow characteristics for uncontrolled- and controlled-flow operations, measure the dynamic loads induced in the cables and supporting devices during placement of the vertical-lift gates, pressures along the structure and velocities in the approach, stilling basin, and exit channel and to determine by observation the relative degree of turbulence in the stilling basin and exit channel. Model tests indicated that partial closure of the gate bays from the top of the structure would be the most effective method of regulating the structure and maintaining satisfactory stilling basin performance and is therefore the recommended plan of regulating the existing structure. (WES)
W77-10018

CHARLESTON HARBOR NAVIGATION STUDY, SOUTH CAROLINA, VERIFICATION TESTS; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
H. A. Benson.
Miscellaneous Paper H-77-4, May 1977. 119 p, 4 fig, 30 tab, 68 pl.

Descriptors: *Hydraulic models, *Prototype tests, *Salinity, *South Carolina, Navigation, Channels, Model studies, Tides, Tidal water, Estuaries. Identifiers: *Charleston Harbor(SC), *Navigation channels.

The Charleston Harbor model reproduced the entire tidal portions of the Ashley, Cooper, and Wando Rivers and a portion of the Atlantic Ocean. The model was of fixed-bed construction and was equipped with all the necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinity intrusion, and other significant phenomena of the prototype. This report is concerned with the hydraulic and salinity verification of the model, and contains complete data showing the degree of accuracy attained with respect to duplication in the model of previous model report and prototype data. The results of the verification tests indicate that the model hydraulic and salinity regimens were in satisfactory agreement with the previous comparable conditions. It therefore can be assumed that the model may be depended on to provide quantitative answers concerning the effects of proposed plans on the hydraulic and salinity regimens of the estuary. (WES)
W77-10019

CONVEX CHUTES IN CONVERGING SUPERCRITICAL FLOW,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
F. M. Neilson.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 733, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper H-76-19, September 1976. 35 p, 14 fig, 32 ref, append, 6 pl.

Descriptors: *Chutes, *Supercritical flow, Flow, Computer models, Flow characteristics, Surfaces.

This study contains a brief literature survey and limited experimental data regarding the water-surface contours for supercritical flow in a steep converging chute. Items relevant to design of the chute sidewalls are described, and the development of a computer model for chute design is suggested. Also, it is suggested that a horizontal transverse water surface cannot be obtained unless parallel sidewalls are used and that for a converging chute, the designer will probably have to evaluate and accept some level of nonuniformity in the flow. (WES)
W77-10020

LONG BEACH HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS; REPORT 2, ALTERNATE PLANS FOR PIER J COMPLETION AND TANKER TERMINAL PROJECT,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. R. Houston.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 066, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper H-76-20, September 1976 (Report 2 of a series). 40 p, 28 pl, 1 append.

Descriptors: *Numerical analysis, *Harbors, *Piers, *California, Model studies, *Finite element analysis, Alternate planning. Identifiers: *Harbor oscillations, *Tanker terminals, *Long Beach harbor(Calif).

A hybrid finite element numerical model was used to calculate harbor resonance for three alternate plans for the Pier J completion and tanker terminal project of Long Beach Harbor. The numerical model calculates harbor oscillation for harbors of arbitrary shape and variable depth. Three finite element grids which covered areas only in the immediate vicinity of breakwater-protected tanker terminal area were used to calculate the response of this area to incident waves with periods from 30 sec to approximately 6 min. (See also W77-10041) (WES)
W77-10040

LONG BEACH HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS; REPORT 4, ALTERNATE PLANS FOR PIER J COMPLETION AND TANKER TERMINAL PROJECT (NO LANDFILL),

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. J. Wanstrath.
Miscellaneous Paper H-76-20, February 1977 (Report 4 of a series). 32 p, 3 fig, 15 pl, 1 append.

Descriptors: *Numerical analysis, *Harbors, *Piers, *California, Model studies, *Finite element analysis, Alternate planning. Identifiers: *Long Beach Harbor(Cal), *Harbor oscillations.

A hybrid finite element numerical model was used to calculate harbor resonance for the Pier J completion and tanker project of Long Beach Harbor with no landfill. The numerical model calculates harbor oscillation for harbors of arbitrary shape and variable depth. A finite element grid which covered the immediate vicinity of the breakwater-protected tanker terminal area was used to calculate the response of this area to incident waves with periods from 30 sec to approximately 6 min. (See also W77-10040) (WES)
W77-10041

LOS ANGELES HARBOR NUMERICAL ANALYSIS OF HARBOR OSCILLATIONS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. R. Houston.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 155, Price codes: A11 in paper copy, A01 in microfiche. Miscellaneous Paper H-77-2, February 1977. 228 p, 1 fig, 2 tab, 198 pl, 11 ref, append.

Descriptors: *Harbors, *Numerical analysis, *California, Model studies, *Finite element analysis. Identifiers: *Harbor oscillations, *Los Angeles Harbor(Cal), *Harbor improvements.

A hybrid finite element numerical model was used to calculate harbor resonance for existing conditions and proposed improvements of Los Angeles and Long Beach Harbors. The numerical model calculates harbor oscillation for harbors of arbitrary shape and variable depth. Ten finite element numerical grids were used to calculate the response of the harbors complex for incident waves with periods from 1 to 10 min. Calculations of the model for existing conditions of the harbors were shown to be in good agreement with prototype measurements. The numerical model calculations indicate that resonant oscillations in existing harbor facilities will not be greatly altered by the proposed modifications of the harbors complex. The largest oscillation in the proposed Liquefied Natural Gas slip and general cargo terminal created by the Terminal Island landfill occurred at a wave period of 258 sec. The seaward side of the Terminal Island landfill did not exhibit significant resonant oscillations for incident waves with periods from 1 to 10 min. (See also W77-02950 and W77-02951) (WES)
W77-10042

FLOW CONDITIONS AT PUMPING STATIONS, CAIRO, ILLINOIS; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
B. P. Fletcher, and J. L. Grace, Jr.

Available from the National Technical Information Service Springfield, VA 22161 as AD-A038 051, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-77-3, March 1977. 62 p, 8 fig, 1 tab, 25 photo, 12 pl.

Descriptors: *Hydraulic models, *Flow, Pumps, *Pumping, Model studies, *Flow characteristics, *Illinois. Identifiers: *Cairo(III).

A model study was conducted to evaluate the characteristics of inflow to the original design sump and to develop modifications required for improving the distribution of flow to the pump intakes. The study indicated the need for certain minor modifications to improve flow characteristics in the forebay and ensure satisfactory flow characteristics and pressures near the pump intakes. The major problems encountered were generated by the concentrated, submerged jet entering and passing through the forebay. The concentrated jet emerging from the approach conduit into the forebay produced adverse currents and turbulence near the pump intakes. Satisfactory approach flows were obtained by installing 6-ft-high baffles in the forebay and rounded pier noses at the entrance to the individual pump bays. The baffles were effective in dispersing the jet entering the forebay and the rounded pier noses eliminated the instability and separation of flow at the entrance to the pump bays. The improved flow distribution eliminated the vapor cavity and certain potential for cavitation damage in the pump intakes. The recommended design provided satisfactory flow performance with all combinations of pump operation and anticipated sump elevations. (WES)
W77-10043

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

CENTER SLUICE INVESTIGATION, LIBBY DAM KOOTENAI RIVER, MONTANA; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.
M. S. Dorich.

Technical Report H-76-21, December 1976. 58 p, 5 fig, 19 tab, 2 photo, 14 pl.

Descriptors: *Sluices, Dams, *Cavitation, *Hydraulic models, Model studies, *Montana, Conduits, Hydraulic structures.

Identifiers: *Libby Dam(Mont), *Kootenai River(Mont), *Center sluice investigations.

The model study of the center sluice, Libby Dam, was conducted to determine the causes of and to develop means for preventing the cavitation damage experienced in the sluices. The study was conducted in a 1:20-scale model of the center sluice which reproduced the 'as-built' geometry of the bell-mounted intake, emergency gate slot, regulating gate and gate well, and parabolic trajectory of the sluiceway. The model helped to define undesirable hydraulic conditions that have caused cavitation damage in the prototype structure. Through the use of the model, an aeration device was developed to ventilate the jet and prevent cavitation damage. The recommended aeratory (type 7) provided a high degree of aeration without adversely altering flow conditions in the sluice. A certain roof modification was suggested to prevent unstable flow and cavitation damage in the sluice intake. (See also W77-10045) (WES)
W77-10044

SLUICE PRESSURES, GATE VIBRATIONS AND STILLING BASIN WALL PRESSURES LIBBY DAM, KOOTENAI RIVER, MONTANA, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

E. D. Hart, and A. R. Tool.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 665, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-76-17, October 1976. 59 p, 10 fig, 5 tab, 22 pl, 9 ref.

Descriptors: *Sluice gates, *Sluices, *Gates, Dams, *Stilling basins, Cavitation, Pressure, *Montana, Conduits, Hydraulic structures.
Identifiers: *Gate vibration, *Libby Dam(Mont), *Kootenai River(Mont).

Two of the three Libby Dam sluices suffered cavitation damage after a short period of operation. During this period of operation, extreme noise was heard and structural movement suspected. Prototype studies were conducted to monitor the sluice pressure fluctuation amplitudes and frequencies as well as sluice gate and structural vibrations. In addition, stilling basin wall pressures were measured during spillway releases. The sluice pressure measurements indicated that negative pressure fluctuation occurred at all points of measurement along the invert (at all gate openings) and that vapor pressure was approached or occurred at three of these locations during certain gate openings. Structural vibrations were generally insignificant whereas the sluice gate was subjected to significant vibrations in all three directions. The mean pressures measured on the stilling basin wall were lower in the upstream, lower portion of the wall and vapor pressure was approached in the upstream lower corner. (See also W77-10044) (WES)
W77-10045

DIVIDE CUT DRAINAGE STRUCTURES TENNESSEE-TOMBIGBEE WATERWAY MISSISSIPPI AND ALABAMA; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. H. Ables, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 666, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-76-18, October 1976. 66 p, 6 fig, 1 tab, 15 photo, 23 pl.

Descriptors: *Hydraulic models, *Drainage systems, *Alabama, *Mississippi, Model studies, Design, Channel improvement, Canals.
Identifiers: *Tennessee-Tombigbee Waterway.

Standardized designs for drainage structures in the Divide Cut Section of the Tennessee-Tombigbee Waterway were developed in model tests conducted on the US Bureau of Reclamation type VI impact basin at a scale of 1:4, on the minor drainage chutes and energy dissipators at a scale of 1:10, and on the major drainage structures at a scale of 1:25. Test results indicate that the type VI impact basin performs satisfactorily below rectangular channels for all discharges tested and critical dimensions are tabulated for discharges expected at drainage structures where the type VI basin will be installed. Generalized information was developed to permit satisfactory design of minor drainage chutes and energy dissipators emptying into the canal. A satisfactory baffled chute spillway was developed for the largest of the drainage structures. Model test results will permit design of the other three major structures based on a unit discharge of 60 cfs common to the five structures for 100-year frequency flows. (WES)
W77-10046

ENTRANCE TO UPSTREAM APPROACH CANAL, GAINESVILLE LOCK, TOMBIGBEE RIVER, MISSISSIPPI AND ALABAMA; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

L. J. Shows, and J. J. Franco.

Available from National Technical Information Service, Springfield, VA 22161 as AD-A033 539, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-76-19, November 1976. 64 p, 12 fig, 6 tab, 22 pl.

Descriptors: *Hydraulic models, *Locks, *Alabama, Model studies, Canals, Mississippi, *Navigation, *Canals, Hydraulic structures, *Channel improvement.
Identifiers: *Tennessee-Tombigbee Waterway, *Gainesville Lock and Dam(Ala), Navigation conditions, *Tombigbee River.

As part of the program for the development of navigation on the Tennessee-Tombigbee Waterway, the Gainesville Lock and Dam will be the first navigation structure proposed for the development of the waterway. A fixed-bed model reproduced about 2.6 miles of the Tombigbee River channel, about 3000 ft of the upstream end of the navigation canal. The model investigation was concerned with the development of good navigation conditions at the entrance to the approach canal and in the two bends just upstream of the entrance to the canal, and in the distribution of flow through the gated spillway. Results of investigation revealed the following: (a) Satisfactory navigation could be developed at the entrance to the lock approach canal by modification of the excavation along the left bank and in the bend adjacent to the canal. (b) Satisfactory navigation conditions for two-way traffic through the reach could be provided under most conditions by the excavation mentioned in (a) above, by increasing channel width, and by improving the curvature of the second bend upstream of the canal. (c) Improving the distribution of flow through the gated spillway with a training wall would have little effect on water-surface elevations upstream. (WES)
W77-10047

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; RE-

PORT 17-4, NUMERICAL MODEL FEASIBILITY STUDY,

Army Engineer Waterway Experiment Station, Vicksburg, Miss.

D. C. Raney, D. L. Durham, and H. L. Butler.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A038 972, Price codes: A08 in paper copy, A01 in microfiche. Technical Report H-74-6, April 1977 (Report 4 of a series). 151 p, 36 fig, 2 tab, 35 ref, append.

Descriptors: *Lake Erie, *Airports, *Waves(Water), Shore protection, Shores, *Feasibility studies, *Model studies, *Ohio.
Identifiers: *Longshore waves, *Wave heights, Cleveland area(Ohio).

An integral part of the feasibility assessment of a proposed offshore jetport site near Cleveland, Ohio, is the investigation of the hydrodynamics of Lake Erie to aid in determining the effects of the structure on such phenomena as seiche, storm surge, and lake circulation. To assist in determining these effects, the feasibility of using numerical modeling techniques was investigated. Numerical models that appeared capable of predicting the extent and magnitude of hydrodynamic changes produced by the proposed jetport were reviewed. A determination was made of the feasibility of applying numerical models to the problems of seiche, storm surge, and lake circulation in Lake Erie. The numerical model feasibility study was restricted to the consideration of existing state-of-the-art models. No extensive model development was undertaken in this feasibility study; however, areas where additional numerical development is required were identified. The theoretical limitations, verification, resolution capabilities, and accuracy of the model as well as the cost of application of the model were considered. (See also W77-10670 and W77-07286) (WES)
W77-10048

IMPACT OF ECONOMIC RISKS ON BOX CULVERT DESIGNS--AN APPLICATION TO 22 VIRGINIA SITES,

Water Resources Engineers, Inc., Springfield, Va. G. K. Young, and M. R. Childrey.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 107, Price codes: A04 in paper copy, A01 in microfiche. Report No FHWA-RD-75-49, August 1974. 52 p, 13 fig, 5 tab, 32 ref. DOT-FH-11-7669.

Descriptors: *Highways, *Culverts, *Economic efficiency, *Design criteria, *Flood damage, Engineering structures, *Risks, Construction costs, Estimating equations, Damages, Flow characteristics, Flow around objects, Excavation, Embankments, Flood routing, Streamflow forecasting, *Virginia.
Identifiers: Box culverts.

Optimal culvert designs for rural four-lane highways, based on economic criteria and data from 22 cases studied in Virginia, seemed to yield smaller cross-section areas than designs based on the conventional 50-year flood criteria. The smaller culverts are about 15% less in cost than culverts designed to the 50-year criteria. The findings summarize a preliminary effort to incorporate economic risks into culvert design and to relate the design to conventional engineering design practices for the 22 culvert sites. Economic design is defined as the minimum annual construction costs plus expected flood-related loss or risk. Each design is evaluated according to a five-step procedure: (1) calculation of annual construction costs, including the cost of the structural excavation, the culvert, embankment and roadway; (2) performing of dynamic flow routings for a series of flood hydrographs (in place of steady-state flood peak discharge in this case, as dynamic routing gives the duration of overtopping which in turn determines the amount of embankment duration and the duration of traffic interruption); (3) esti-

mation of embankment erosion; (4) calculation of losses from damage to the site, traffic-related damage and upstream property damage; (5) weighing of losses with flood probabilities to derive risks. (Harris-Wisconsin)
W77-10067

PROPOSED PIPELINE SYSTEM WILL LINK WATER SCHEMES DWA'S R24 MILLION BALANCING ACT.

Construction in Southern Africa, Vol 21, No 2, p 49-52, May 1976.

Descriptors: *Pipelines, Inter-basin transfers, Water requirements, Thermal powerplants, Water resources, Distribution systems, Africa.
Identifiers: *Transvaal, *South Africa, Komati River, Usutu River, Escom.

The Department of Water Affairs has recently proposed a R24 million system of pipelines to link the Komati and Usutu Government water schemes. The project will allow shortages in one system to be relieved by using surpluses in the other and will enable the Department to meet the projected water requirements of the Electricity Supply Commission's (Escom) power stations in the Eastern Transvaal. It is envisaged that the scheme could be completed by the mid-1980's. (So African Water Info Ctr)
W77-10069

8C. Hydraulic Machinery

MOTOR POWERED BY WAVE ACTION, R. M. Axford.

U. S. Patent No. 4,002,416, 5 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 954, no 2, p 731, January 11, 1977.

Descriptors: *Patents, *Waves(Water), Ocean waves, Surf, Pumps, Energy conversion, Energy transfer, Equipment.

A motor, in the form of a pump, is primarily designed to be activated by the oscillating motion of waves and has a paddle placed to oscillate about a stationary horizontal axis located in the plane of the paddle. The paddle is placed in the surf and positioned where the wave action is greatest so that the force of the waves can act on the paddle to cause it to oscillate back and forth, one cycle with each wave. The paddle is on a stationary axis. The oscillating motion of the paddle is coupled to a suitable pump which pumps sea water. The pump has a cylindrical housing concentric with the stationary axis. A radial vane is fixed to a shaft within the housing while the paddle is fixed to the shaft outside the housing. Suitable valves are provided in the housing to allow sea water to enter and exit under action of the oscillating vane. (Sinha - OEIS)
W77-09803

GEAR MOTOR SOLVES PLANT'S NOISE PROBLEM.

Water and Sewage Works, Vol 124, No 5, p 59, May, 1977.

Descriptors: *Gears, *Pumps, *Treatment facilities, Performance, *Aeration, Oxygen demand, Equipment, Microorganisms, Activated sludge, *Waste water treatment.
Identifiers: Noise problem(Treatment facilities).

Noise problems of secondary tank aerators were resolved during an expansion and modernization program at a Mecca, California, treatment plant. Noise from the gearbox drives was negated when a new aeration tank at the secondary stage was constructed. The mechanical aerator installed produced very little vibration, torquing, or tilting of a nearby catwalk. Tolerances of .0025 inches were maintained on drive train units. There was no oil spill or leakage and the unit ran cool to the

touch. A 'superfine' sparger supplied air through peripheral holes at 20 psi and about 100,000 cu ft/day. Aerator blades forced rising bubbles back down through the waste. Bubbles were also forced outward to the tank sides. This provided the oxygen demand needed by microorganisms. Around-the-clock operation has required little maintenance and noise complaints have dropped to zero. Constant density changes in the tank results from the highly efficient air mixing; this is related to shock load to the aerator and to the gear drive. (Collins-FIRL)
W77-09827

DEMONSTRATING THE FEASIBILITY OF VACUUM AND PRESSURE SEWERS,

C and G Engineering, Salem, Ore.
For primary bibliographic entry see Field 5D.
W77-09834

DESIGN PROPOSALS FOR SUBMERSIBLE SEWAGE LIFT STATIONS,

H. G. Kelly.
Water and Sewage Works, Reference Issue, p 76-78, 80-84, 86, 88-90, April, 1977. 12 fig, 2 tab, 18 ref.

Descriptors: *Hydraulic design, *Hydraulic structures, *Pumps, *Sewers, Construction materials, Performance, Design criteria, Operation and maintenance, Flow rates, Costs, Control systems.
Identifiers: Submersible lift stations(Sewage).

Designs were presented for submersible sewage lift stations. Submersible lift stations are economical alternatives to larger dry well/wet well stations. They can also be used to handle flows until increased flows require larger facilities. Design factors considered were construction materials, sizing, pump types, power and controls, hydraulic conditions, operation and maintenance needs, and costs. Practical design can be achieved for flows less than 1500 gpm. Centrifugal pumps are generally used, but progressive cavity pumps and pneumatic ejectors have been used in low flow-high head applications. Concrete, fiberglass, or a protected metal are the usual construction materials, depending upon specific site, design, and construction considerations. Sizing and pump selection should be based on accurate design inflow estimations. Pumps should also perform reliably and have a good service record, as well as conform to head requirements. A friction loss equation should be derived before the selection of system components, and the system head curve should reflect its optimum solution. System hardware should be selected for ease of installation, operation, maintenance, cleaning, and repair. The well must be large enough to provide pump operation times which would prevent material accumulation and septicity. The range of liquid level controls includes float and pneumatic bubbler controls, ultrasonic echo controls, and pressure sensing tubes with time delays. Pump motors should be installed with non-overloading features. Horsepower should run out a certain percentage of the pump characteristic curve past the intended operation point. Grinder pumps provided alternatives for low flow applications. They were economical and simple, and could be used for individual homes or in a station for several homes or sources. Installation and material costs can determine the type of station constructed. Individual preference may overrule cost comparison in this selection. Operation and maintenance costs should be considered, as well as the costs of downtime. (Collins-FIRL)
W77-09839

SEWAGE EJECTORS AVOID MANUAL UNBLOCKING OF PIPES.

Process Engineering, p 11, March, 1977.

Descriptors: *Hydraulic machinery, *Sewage treatment, Screens, Pumps, Pipes, Liquid wastes, Solid wastes, Maintenance, Performance, Equipment, Waste water treatment.

Identifiers: *Sewage ejectors(Hydraulic).

An East Anglian, England, hospital replaced sewage handling centrifugal pumps with gravity filled electromechanical sewage ejectors. This immediately reduced the maintenance problems encountered through pipe blockage by cloth, toys, and other solid materials. A roller screen on skids prevented passage of such solid materials into the mechanism. The ejectors, with 30 hp compressors, were able to handle up to 12 liters/second. The ejectors have proven themselves most reliable and were considered more effective than rotary valve or electrode control units. There were no floats or electrodes in the sewage flow. (Collins-FIRL)
W77-09856

ANALYSIS OF ECONOMIC SEWAGE LIFT STATION DESIGN,

Stanley Associates Engineering, Ltd., Edmonton (Alberta).
O. Smolik.

Water and Sewage Works, Reference Issue, p 58-62, April, 1977. 8 fig.

Descriptors: *Pumping plants, *Design, Inflow, Hydraulic engineering, Hydraulic machinery, *Sewage, Conveyance structures, Analytical techniques, Pumps, Performance, Equipment, Economics.
Identifiers: *Lift stations(Sewage).

A procedure for the economical design of a sewage lift station was presented. The objective was to determine a standard type or size of station and a standard control for specific magnitudes of inflow. Design problems included wet well size and the capacity and number of pumps for a given sewage inflow. Equations were included which could aid the determination of relationships between well size, pump efficiency, and sewage inflow. Other equations were designed to specify inflow at a station with no flowmeter. Use of these steps was expected to reduce costs at the design stage and to increase efficiency of the system. (Collins-FIRL)
W77-09906

FLOW CONDITIONS AT PUMPING STATIONS, CAIRO, ILLINOIS; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-10043

HYDRO-ELECTRIC DEVELOPMENT OF THE TUGELA RIVER,

Department of Water Affairs, Pretoria (South Africa).
T. P. Van Robbroeck, and B. W. Graber.
Energy, Vol 2, No 3, p 10-19, June 1976. 6 fig, 1 tab, 5 ref.

Descriptors: *Hydroelectric plants, *Pumped storage, Rockfill dams, Dam design, Hydrologic data, Africa.
Identifiers: *Tugela River(Natal), *South Africa, Buffalo River, Kotongweni Dam, Ntulanwa Dam, Mvumase Dam.

A scheme is proposed as the first step for the hydro-electric development of the Tugela River, consisting of two large dams and one small dam to support a total installed capacity of 5 200 MW, comprising 3 700 MW of conventional hydro plant and 1 500 MW of pumped storage plant. In addition to supplying cheap peaking power to the interconnected system network of Escom, the hydro-electric development of the Tugela River would offer numerous benefits such as irrigation, water supply, flood control, recreation facilities, fishing, saving of foreign currency, prestige value, etc. (So African Water Infor Ctr)
W77-10073

Field 8—ENGINEERING WORKS

Group 8C—Hydraulic Machinery

8D. Soil Mechanics

STATIC CALCULATION OF DRAINAGE CHANNELS AND PIPES (DIE STATISCHE BERECHNUNG VON ENTWASSERUNGSKANALEN UND-LEITUNGEN).
For primary bibliographic entry see Field 8G.
W77-09833

SEEPAGE FROM SMALL EARTH DAMS,
Western Australia Dept. of Agriculture, South Perth.
R. G. Pepper.
Australian Journal of Soil Research, Vol 15, p 39-50, 1976. 2 fig, 3 tab, 42 ref, 1 append.

Descriptors: *Seepage, *Soil mechanics, *Soil sealants, *Earth dams, *Hydraulic conductivity, Australia, On-site investigations, Water balance, Soil water movement, Soil chemical properties, Soil investigations, Soil profiles, Tensiometers, Permeameters, Laterites.

Seepage from small earth dams (excavated tanks) studied in the Badgingarra area of Western Australia was governed by a 0.2 m thick sealing layer of soil bounding the excavation, with hydraulic conductivity about one-tenth that of soil deeper in the profile. The hydraulic properties of this layer were determined for dams in the area using tensiometers and samples from permeameters. Results from water balance studies on several earth tanks indicated that hydraulic conductivity variations were attributable to sand content, exchangeable magnesium and sodium percentages, and dithionite extractable iron and aluminum in the soil. Disturbing lateritic soils disrupts the in situ structure so that laboratory results on hydraulic conductivity are not applicable to the field situation. Details of the experimental techniques and soil studies are presented, along with equations to be used in such studies. (Jahns-Arizona)
W77-09932

HYDRO-ELECTRIC DEVELOPMENT OF THE TUGELA RIVER,
Department of Water Affairs, Pretoria (South Africa).
For primary bibliographic entry see Field 8C.
W77-10073

8E. Rock Mechanics and Geology

TUNNELLING WORK FOR THE RUACANA SCHEME,
For primary bibliographic entry see Field 8A.
W77-09688

DURBAN TUNNELS UNDER THE MICROSCOPE,
Durban City Engineers Dept. (South Africa).
For primary bibliographic entry see Field 8A.
W77-09689

A UNIQUE MEANS OF OBTAINING SEA-WATER,
South West African Consolidated Diamond Mines Ltd., Oranjemund.
G. R. Walker.
Journal of the South African Institute of Mining and Metallurgy, Vol. 76, No. 10, p 412-422, May 1976. 3 fig, 1 ref.

Descriptors: *Sea water, Water requirements, *Tunnelling, Mining engineering, Mineral industry, Rock excavation, *Water supply, *Industrial water, Tunnel construction, Tunnel design.
Identifiers: South West Africa, Southern Africa, Atlantic Ocean.

Although the mining and treatment operations at The Consolidated Diamond Mines of South West Africa, Limited, are located within an average distance of 1 km from the Atlantic Ocean, the supply of clear sea-water in large and continuous quantities for use in treatment plants is made difficult by siltation of water-holes and the amount of sand in suspension in the sea itself. The need for sixty million litres of sea-water per day at the new No. 2 treatment plant necessitated the construction of a system that would ensure a continuous and reliable supply. Several sea-water intake schemes were proposed. The need for an improved means of obtaining water is discussed and the construction of the scheme eventually chosen—a tunnel driven through bedrock for over 400 m beneath the Atlantic Ocean is described. At the end of the tunnel, two large chambers were excavated from which vertical holes were drilled to intersect the sea-bed. (So. African Water Info Center)
W77-09692

CHICAGO PLAN DESIGNED FOR POLLUTION AND FLOOD CONTROL.
For primary bibliographic entry see Field 4A.
W77-09838

EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE PERU-CHILE TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 2L.
W77-09983

8F. Concrete

CORROSION AVOIDANCE IN WATER AND SEWAGE PIPELINES,
T. R. Smith.
Water Services, Vol. 82, No. 973, p 143, 145, 146, March, 1977.

Descriptors: *Corrosion control, *Sewers, *Piping, *Linings, Iron, Concrete, Plastics, Costs, Maintenance costs, Construction materials, Evaluation, Prestressed concrete.
Identifiers: Ductile iron, Polyethylene, Glass reinforced plastics, Reinforced plastic mortar.

Current economic conditions dictate that water and sewage pipelines be chosen for the lowest overall costs. These costs not only include the pipe cost, but installation and maintenance costs. The latter depends greatly on pipe life-aging and breakage. Corrosion, which contributes greatly to aging and breakage, should be minimized. Ductile iron is generally coated with a tar or bitumen-based substance which enhances its metal corrosion resistance, and especially its oxide skin. Great reliance is placed on cement mortar linings. Sulfate resisting cement is often specified for ductile iron linings. Other lining materials include epoxy resin systems and loose polyethylene film. Better application methods are being developed for polyethylene to provide resistance to extremely corrosive environments. Prestressed concrete pipes can be used under conditions of sulfate levels exceeding 5000 ppm when a proprietary wrapping tape system is used or when the pipes are installed in limestone surroundings. The very dense structure of concrete gives it an improved corrosion resistance similar to that of prestressed concrete. When sulfates are present in soils, a sulfate resistant cement should be specified. Corrosion resistance can be improved by using a hard calcareous aggregate such as dolomite. Glass reinforced plastics (GRP) or reinforced plastic mortar (rpm) pipes provide corrosion resistance at a reasonable cost. Proper installation of this pipe is necessary for obtaining the full benefits of its resistance properties.

Soil analyses can aid in determining the pipe composition and the means of protection needed. (Collins-FIRL)
W77-09832

PVC LINING—THE ANSWER TO CORROSIVE ATTACK BY H2S IN CONCRETE SEWERS AND STRUCTURES.
For primary bibliographic entry see Field 8G.
W77-09835

SYNTHETIC AGGREGATES MADE FROM SEWAGE PLANT SLUDGE.
Engineering News-Record, Vol 199, No 18, p 13, May, 1977.

Descriptors: *Aggregates, *Concrete technology, Sludge disposal, Incineration, Particle size, Construction materials, Shales, Physical properties, Specific gravity, Waste disposal, Recycling, *Water treatment.

A method was devised to produce lightweight synthetic aggregates from sewage sludge for use in concrete. Ash of incinerated sludge was mixed with crushed shale, water, and binding materials. This mixture was heated to 2,200 F and molded into 0.4-inch diameter balls having a porous interior and a nonporous, compact surface layer. Their specific gravity was 1.2 compared to an average of 1.5 for other synthetic aggregates. Only laboratory production has been successful, but the size and shape of the balls could be adjusted for commercial usage. (Collins-FIRL)
W77-09924

8G. Materials

STATIC CALCULATION OF DRAINAGE CHANNELS AND PIPES (DIE STATISCHE BERECHNUNG VON ENTWASSERUNGSKANALEN UND-LEITUNGEN),
W. Zschke.
Berichte der Abwassertechnischen Vereinigung e.V., No 29, p 107-122, 1976. 12 fig, 17 ref.

Descriptors: *Sewers, Analytical techniques, *Loads(Forces), Viscous flow, Specific gravity, Friction, Mechanical properties, Physical properties, Conduits, Soil mechanics, Stress analysis, Drainage, *Drainage, *Pipes.
Identifiers: *Static calculations.

The static calculation of statically stiff and soft pipes is presented. The basic soil mechanical parameters necessary to load calculation are specific gravity, viscous flow, and modulus of deformation. The earth load is reduced by the friction forces of the wall. The traffic load is calculated on the basis of Boussinesq's theory. Various formulas for the determination of the stress concentration in stiff pipes, and the Iowa formula for statically soft pipes, are presented. The live load is nearly independent of the pipe-laying conditions; it can be assumed to be rectangular. While statically stiff pipes should be chosen on the basis of stress or load-bearing capacity calculations, the long-term and short-term deformations, and possibly the stresses, should be calculated for statically soft pipes. The maximal permissible relative change in the vertical diameter of soft pipes is 6%. (Takacs-FIRL)
W77-09833

PVC LINING—THE ANSWER TO CORROSIVE ATTACK BY H2S IN CONCRETE SEWERS AND STRUCTURES.
Water Services, Vol. 82, No. 973, p 161-162, March, 1977.

Descriptors: *Linings, *Plastics, *Corrosion control, *Concrete structures, Hydrogen sulfide, Physical properties, Chemical properties, Sewers,

Sulfur compounds, Aerobic conditions, Design criteria.
Identifiers: Polyvinyl chloride(PVC).

Polyvinyl chloride (PVC) linings were studied in Australia as a preventive measure for hydrogen sulfide corrosion in concrete sewers and structures. Factors involved in this type of corrosion are temperature, sewer design, and degree of turbulence. High temperature increases the rate of corrosive attack. Hydrogen sulfide corrosion can be broken down to four stages: sulfur compounds natural to sewage or formed by bacterial activity in anaerobic conditions provide a sulfide content; H₂S gas is released into the sewer atmosphere depending on the relative humidity, the degree of turbulence, and the pH in the sewer flow; H₂S is oxidized by bacteria, reducing the pH and forming sulfuric acid on the concrete; and the sulfuric acid reacts with lime and hydrated calcium silicates in cement to destroy its structure and reduce it to a putty-like paste. Any protective lining should be resistant to waste constituents and sulfuric acid. It should be suitable for sewer use, remain in place, be unaffected by bacterial actions, be formed as a continuous coating throughout the entire system, and be easily identifiable and repairable in case of accidental damage. A patented process was developed to embed PVC sheets in concrete pipes. They are placed to avoid moisture buildup between the PVC sheets and the concrete, and methods were developed to join sheets between successive pipes after laying them. A lining testing method was also developed to ensure the lining's integrity. (Collins-FIRL)

W77-09835

WATERTIGHT CASE FOR POND LINERS.
For primary bibliographic entry see Field 5G.
W77-09891

IGLOO WAVE ABSORBER TESTS FOR PORT WASHINGTON HARBOR, WISCONSIN; HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 8B.
W77-09990

MAKING SURE OF PIPELINE PERFORMANCE.
For primary bibliographic entry see Field 8A.
W77-10068

SEWER-MAINTENANCE PRACTICE AND EQUIPMENT.
Durban City Engineers Dept. (South Africa).
D. C. MacLeod.
Municipal Engineer, Vol 7, No 1, p 43-51, 1976. 6 fig, 2 tab, 4 ref.

Descriptors: Sewerage, Operation and maintenance, Equipment, Design, Cleaning, Safety aspects, Construction materials, Africa.
Identifiers: Durban(South Africa).

Reviews are presented of sewer-maintenance practice and equipment against the background of experience and practice in the Durban municipal area. Reference is made to design practices, construction materials, sewer cleaning equipment, closed-circuit TV inspection of sewers, manhole spacing practice, waste-food disposal units, and the safety and public health aspects of sewer maintenance. (So African Water Info Center)

W77-10078

8I. Fisheries Engineering

HOW A HEAT PUMP IMPROVED WATER CONDITIONS AT A FISH HATCHERY.
Cornell Univ., Ithaca, N.Y. Dept. of Thermal Engineering.

For primary bibliographic entry see Field 05C.
W77-09791

PRODUCTIVITY OF CLARIAS BATRACHUS IN THE SEWAGE FERTILIZED FISH PONDS,
National Environmental Engineering Research Inst., Nagpur (India).
For primary bibliographic entry see Field 05C.
W77-09922

THE DARWENDALE RESERVOIR AS A FISHERY,
Rhodes Univ. (Salisbury). Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W77-10096

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WEATHER MODIFICATION EFFECTS AND MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS),
National Technical Information Service, Springfield, Va.
For primary bibliographic entry see Field 02B.
W77-09694

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: KETONIC SOLVENTS,
Syracuse Research Corp., N.Y. Center for Chemical Hazard Assessment.
For primary bibliographic entry see Field 05B.
W77-09770

ANNOTATED EXTRACTS OF SOME PAPERS DEALING WITH THE MEASUREMENT AND SOLUBILITY OF DISSOLVED ATMOSPHERIC GASES, WITH NITROGEN GAS SUPERSATURATION, AND WITH GAS BUBBLE DISEASE IN FISH,
British Columbia Water Resources Service, Victoria.
For primary bibliographic entry see Field 05C.
W77-09792

WASTEWATER MICROBIOLOGY,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 05D.
W77-09893

THE GEORGIA COASTAL ENVIRONMENT. A COMPILATION OF RESOURCE MATERIALS COVERING THE COASTAL PLAIN, ESTUARIES AND OFFSHORE WATERS.
Army Engineer District, Wilmington, N.C.
For primary bibliographic entry see Field 02L.
W77-10025

RESEARCH AND DEVELOPMENT

The first of the three major areas of research and development is the basic sciences. This area includes the study of the fundamental principles of nature and the discovery of new knowledge.

The second major area of research and development is the applied sciences. This area involves the use of scientific knowledge to solve practical problems and to develop new technologies.

The third major area of research and development is the engineering sciences. This area focuses on the design and development of new products and processes.

The fourth major area of research and development is the social and behavioral sciences. This area studies human behavior and the social interactions between individuals and groups.

The fifth major area of research and development is the environmental sciences. This area deals with the study of the natural environment and the impact of human activities on it.

The sixth major area of research and development is the health and medical sciences. This area focuses on the study of human health and the development of new medical treatments.

The seventh major area of research and development is the agricultural sciences. This area involves the study of the natural world and the development of new agricultural technologies.

The eighth major area of research and development is the space and planetary sciences. This area deals with the study of the universe and the development of space exploration technologies.

The ninth major area of research and development is the oceanographic sciences. This area focuses on the study of the oceans and the development of marine technologies.

The tenth major area of research and development is the atmospheric sciences. This area involves the study of the atmosphere and the development of weather forecasting technologies.

The eleventh major area of research and development is the geophysical sciences. This area deals with the study of the Earth's interior and the development of geophysical technologies.

The twelfth major area of research and development is the planetary sciences. This area focuses on the study of other planets and the development of planetary exploration technologies.

The thirteenth major area of research and development is the astrophysical sciences. This area involves the study of the universe and the development of astrophysical technologies.

The fourteenth major area of research and development is the cosmological sciences. This area deals with the study of the universe and the development of cosmological technologies.

The fifteenth major area of research and development is the particle physics sciences. This area focuses on the study of the fundamental particles of matter and the development of particle physics technologies.

The sixteenth major area of research and development is the nuclear physics sciences. This area involves the study of the nucleus of an atom and the development of nuclear physics technologies.

The seventeenth major area of research and development is the quantum physics sciences. This area deals with the study of the behavior of matter at the atomic and subatomic levels and the development of quantum physics technologies.

The eighteenth major area of research and development is the relativistic physics sciences. This area focuses on the study of the behavior of matter at high speeds and the development of relativistic physics technologies.

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The twenty-third major area of research and development is the nuclear physics physics sciences. This area deals with the study of the nucleus of an atom and the development of nuclear physics physics technologies.

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The twenty-seventh major area of research and development is the cosmological physics physics sciences. This area focuses on the study of the universe and the development of cosmological physics physics technologies.

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The thirty-fourth major area of research and development is the cosmological physics physics sciences. This area involves the study of the universe and the development of cosmological physics physics technologies.

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The thirty-eighth major area of research and development is the quantum physics physics sciences. This area deals with the study of the behavior of matter at the atomic and subatomic levels and the development of quantum physics physics technologies.

SUBJECT INDEX

2
Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

2-4-5-T
Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B

3-TRIFLUOROMETHYL-4-NITROPHENOL
Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

3-TRIFLUOROMETHYL-4-NITROPHENOLS
Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

ABSORPTION

Evaluation of the Parameters of Soil Phosphorus Availability Factors in Predicting Yield Response and Phosphorus Uptake, W77-09646 2G

Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F

Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F

Lead and Freshwater Fishes: Part 2-Ionic Lead Accumulation, W77-09779 5C

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

ABSTRACTS

Weather Modification Effects and Management (A Bibliography with Abstracts), W77-09694 2B

ACIDIC SOILS

Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G

ACTIVATED CARBON

Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D

Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D

Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D

ACTIVATED SLUDGE

Some Effects of Lime Addition on High Solids, Completely Mixed, Activated Sludge Waste Water Treatment, W77-09601 5D

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D

Highly Efficient Aerating System-For An Activated Sludge Effluent Treatment Plant, with Restricted Liquid Circulation in Aerating Tank. W77-09844 5D

Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D

Nitrification in a Chlorinated Activated Sludge Culture, W77-09851 5D

Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant, W77-09854 5D

Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D

The Activated Sludge Process, Part 1 - Steady State Behaviour, W77-10094 5D

ADRIATIC SEA

Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

ADSORPTION

Adsorption of Dodecylbenzene Sulfonate on NA(+)-Montmorillonite: Effect of Salt Impurities, W77-09651 2G

The Effect of Mirex on the Burrowing Activity of the Lugworm (Arenicola Cristata), W77-09675 5C

Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

AERATED LAGOONS

BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D

AERATION

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

Water Purifying Systems, W77-09808 5F

Water Treatment System with Prolonged Aeration, W77-09818 5G

Aerating Apparatus, W77-09819 5G

Gear Motor Solves Plant's Noise Problem. W77-09827 8C

Highly Efficient Aerating System-For An Activated Sludge Effluent Treatment Plant, with Restricted Liquid Circulation in Aerating Tank. W77-09844 5D

Thurrock Test-Bed for ICI Deep Shaft, W77-09859 5D

Waste Purification Process. W77-09865 5D

Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D

Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D

Mixer Cuts Solids Up and Time Down for Waste Treatment. W77-09885 5D

Aeration: Proper Sizing is Critical, W77-09905 5D

BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D

AERATION TANKS (DESIGN)

Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D

AERIAL PHOTOGRAPHY

The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing, W77-10007 2H

AEROBIC CONDITIONS

ATP Content and Mortality in Mytilus Edulis from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D

AEROBIC TREATMENT

Method and Apparatus for Aerobic Sewage Treatment, W77-09805 5D

AEROLOGICAL METHODS

Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe, W77-09710 2D

SUBJECT INDEX

AEROLOGICAL METHODS

AFRICA

The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba, W77-09614 5C

Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C

Arid Lands of Sub-Saharan Africa. W77-09934 6E

AGGREGATES

Synthetic Aggregates Made from Sewage Plant Sludge. W77-09924 8F

AIR CIRCULATION

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

AIR POLLUTION

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

AIRPORTS

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

ALABAMA

Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

ALASKA

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

ALBERMARLE-PAMLICO REGION (NC)

Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L

ALGAE

Analysis of the Population Dynamics of Oscillatoria Redekii Van Goor in Lake Edeberg, W77-09629 5C

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

Calcium Carbonate Formation by Enteromorpha Nana Algae in a Hypersaline Volcanic Crater Lake, W77-09787 2H

ALGAL CONTROL

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

ALGAL TOXINS

Microcystis Toxins: Isolation, Identification, Implications, W77-10093 5A

ALKALIS (BASES)

Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G

ALTERNATIVE PLANNING

Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation, W77-09985 6G

ALUM

Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment, W77-09847 5D

Chemical Treatment of Sewage, W77-09892 5D

ALUMINUM HYDROXIDE

Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G

AMMONIA

Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers, W77-09642 3F

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A

Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D

AMMONIA-NITROGEN

Ammonia Volatilization from Surface Applications of Ammonium Compounds on Calcareous Soils: V. Soil Water Content and Method of Nitrogen Application, W77-09960 2G

AMMONIA VOLATILIZATION

Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers, W77-09642 3F

AMMONIUM COMPOUNDS

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

The Influence of Cation Exchange Capacity and Depth of Incorporation on Ammonia Volatilization from Ammonium Compounds Applied to Calcareous Soils, W77-09961 2G

AMPHIPODA

Thermal Tolerance of Two Species of Gammarus, W77-09730 5C

ANABAENA

Filtering Rate Inhibition of Daphnia Pulex in Wintergreen Lake Water, W77-09910 5C

ANAEROBIC BACTERIA

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B

ANAEROBIC CONDITIONS

ATP Content and Mortality in Mytilus Edulis from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

ANAEROBIC CONTACT FILTER

Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D

ANALYSIS

Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A

ANALYTICAL TECHNIQUES

Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D

A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A

Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A

Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A

Determination of Arsenic Species in Natural Waters, W77-09747 5A

Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

Method for the Determination of the Conditionability of Sewage Sludge (Erarbeitung von Methoden zur Ermittlung der Konditionierbarkeit von Klaufschlaemmen), W77-09884 5D

Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A

SUBJECT INDEX

ATP

ANIMAL PATHOLOGY

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, 5C

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., 5C

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, 5C

ANNELIDS

Effect of Organic Excretion by Benthic Annelids on the Productivity of Phytoplankton, 5C

ANNUAL PEAK DISCHARGE

Return Periods of Hydrological Events, 2B

ANODONTA

The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), 5C

AQUATIC ALGAE

Intensive Large City Influence on Reed-Banks, (In German), 5C

AQUATIC ANIMALS

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, 5C

The Case for the Expanded Study of Freshwater Pollution Zoology, 5C

AQUATIC ENVIRONMENT

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, 5C

AQUATIC HABITATS

Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), 2H

AQUATIC INSECTS

Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), 2I

AQUATIC LIFE

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, 2L

AQUATIC PLANTS

Macrophyte-Sediment Relationships in Chautauqua Lake, 5C

AQUATIC PRODUCTIVITY

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, 5C

AQUATIC WEED CONTROL

Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, 4A

Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides, 4A

AQUICULTURE

Influence of Certain Water Conditions, Especially Dissolved Gases, on Trout, 5C

AQUIFER CHARACTERISTICS

The Cockfield Aquifer in Mississippi, 7C

Ground-Water Resources of the Lexington, Kentucky, Area, 4B

Geohydrology of Muscatine Island, Muscatine County, Iowa, 4B

Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year, 2F

AQUIFERS

An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, 2F

ARCTIC

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, 5B

ARCTIC MARINE SEDIMENTS

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, 5B

ARENICOLA

The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), 5C

ARID LANDS

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, 2A

Arid Lands of Sub-Saharan Africa, 6E

ARIZONA

Colorado River Basin Salinity Control Project--Title I, 5D

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, 2G

ARKANSAS

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, 8B

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year, 7C

Bottom Withdrawal can Enhance Lake Water Quality, 5G

ARKANSAS RIVER

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, 8B

AROCLOL

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), 5A

AROCLOL 1254

Effects of Aroclor (R) 1254 on Brook Trout, *Salvelinus Fontinalis*, 5C

AROCLORS

Effects of Aroclor (R) 1254 on Brook Trout, *Salvelinus Fontinalis*, 5C

ARSENIC COMPOUNDS

Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS, 5B

Determination of Arsenic Species in Natural Waters, 5A

ARSENIC RESIDUES (SOILS)

Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS, 5B

ARTIFICIAL WATERCOURSES

Bay Springs Lake Water-Quality Study, 5B

ASPERGILLUS

Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, 5C

ASPHYXIATION

Influence of Certain Water Conditions, Especially Dissolved Gases, on Trout, 5C

ATLANTIC OCEAN

Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), 7C

North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present, 2J

The Bottom Mixed Layer on the Continental Shelf, 2L

ATMOSPHERIC GASES

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, 5C

ATOMIC ABSORPTION ANALYSIS

Atomic Absorption in Water and Waste Water Analysis, 5A

ATP

ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, 5C

SUBJECT INDEX

AUSTRALIA

AUSTRALIA

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

AUTOMATIC CONTROL

Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

AUTOMATION

An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch), W77-09613 2G

Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

AVALANCHES

Movement of Snow Avalanches, W77-09716 2C

Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C

AVOIDANCE REACTIONS (FISH)

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

AZOV VIMBA

Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H

BACTERIA

Temperature Effects on the Denitrification Products by Two Aquatic *Pseudomonas* Species, W77-09607 5C

Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D

BACTERIAL PROTEINS

Growth Responses of Clicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C

BALTIC SEA

Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe, W77-09710 2D

Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A

BANK EROSION

Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L

BARLEY

Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat, W77-09655 3F

BASAL TILLS

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

BASELINE STUDIES

Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C

Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L

Identification and Analysis of Mid-Atlantic Onshore OCS Impacts, W77-10027 5C

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, W77-10029 2L

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

An Investigation of the Nearshore Region of Lake Ontario IFYGL, W77-10053 5C

BASIC DATA COLLECTIONS

Ground-Water Levels in Observation Wells in Oklahoma, 1975, W77-09999 7C

BASS

Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C

BATHYMETRY

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

BAY SPRINGS LAKE (MISS)

Bay Springs Lake Water-Quality Study, W77-10055 5B

BAYS

The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel, W77-09944 2L

BEACH NOURISHMENT

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, W77-10029 2L

BEACHES

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, W77-10029 2L

BEAR CREEK BASIN (SOUTHWESTERN ORE)

1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A

BEHAVIORAL MECHANISMS

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

BEHAVIORAL SYMPTOMS

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

BELGIUM

A Practical Apparatus for Quantitative Sampling of Epilithic Periphyton, (In French), W77-09623 7B

BENTHIC FAUNA

The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), W77-09675 5C

Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A

The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel, W77-09944 2L

Studies on the Bottom Fauna of Four Lakes in Eastern Hokkaido (Lakes Kushiyaro-Ko, Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In Japanese), W77-10028 5C

BENTHIC FLORA

Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C

BENTHOS

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Impact on Marine Benthos of Waste Water Discharge, W77-09846 5C

BENZENE

Standardization of Methylmercury Analysis, W77-09775 5A

BERMUDA GRASS

Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G

SUBJECT INDEX

BROOK TROUT

BIBLIOGRAPHIES

Weather Modification Effects and Management
(A Bibliography with Abstracts),
W77-09694 2B

The Georgia Coastal Environment. A Compilation
of Resource Materials Covering the
Coastal Plain, Estuaries and Offshore Waters.
W77-10025 2L

BICARBONATES

Concerning the Influence of the Hydrogen Ion
Concentration and of the Bicarbonate Con-
centration on the Structure of Biocenoses of
Mountain Brooks, (In German),
W77-09620 2I

BILHARZIASIS

The Tugela-Vaal State Water Scheme as a Bil-
harzia Risk (Die Tugela-Vaal-Staatswaterskema
as 'n Bilharziarisiko),
W77-09690 5G

BIOACCUMULATION

Lead and Freshwater Fishes: Part 2--Ionic
Lead Accumulation,
W77-09779 5C

Effects of Aroclor (R) 1254 on Brook Trout,
Salvelinus Fontinalis,
W77-09783 5C

BIOASSAY

Influence of Cation Content on the Biological
Activity of Fensulfuthion in Plainfield Sand,
W77-09639 2G

Toxicity of Hydrogen Sulfide to Various Life
History Stages of Bluegill (*Lepomis
macrochirus*),
W77-09668 5C

The Toxicity of Malathion and Its Hydrolysis
Products to the Eastern Mudminnow, *Umbra
pymmaea* (DeKay),
W77-09670 5C

The Effect of Mirex on the Burrowing Activity
of the Lugworm (*Arenicola Cristata*),
W77-09675 5C

Continuous-Flow Apparatus for Use in Petrole-
um Bioassay,
W77-09681 5A

Toxicity of 3-trifluoromethyl-4-nitrophenol
(TFM), 2',5-dichloro-4'-nitrosalicylanilide
(Bayer 73), and a 98:2 Mixture to Fingerlings of
Seven Fish Species and to Eggs and Fry of
Coho Salmon,
W77-09764 5C

Evaluation of a Laboratory Microcosm for
Study of Toxic Substances in the Environment:
Final Technical Report, July 1, 1973-December
31, 1975,
W77-09769 5A

Lead and Freshwater Fishes: Part 2--Ionic
Lead Accumulation,
W77-09779 5C

Effects of Aroclor (R) 1254 on Brook Trout,
Salvelinus Fontinalis,
W77-09783 5C

Effects of Exposure to Heavy Metals on
Selected Fresh Water Fish. Toxicity of Copper,
Cadmium, Chromium and Lead to Eggs and
Fry of Seven Fish Species,
W77-09784 5C

Acute Toxic Effects of Petroleum Refinery
Wastewaters on Redear Sunfish,
W77-09786 5C

The Effect of High Concentrations of Dis-
solved Oxygen on Several Species of Pond
Fishes,
W77-09789 5C

Microcystis Toxins: Isolation, Identification,
Implications,
W77-10093 5A

BIOCHEMICAL OXYGEN DEMAND

Using O(xygen) D(emand) I(ndex), COD, and
BOD Tests to Characterize Kraft Mill Effluent,
W77-09729 5A

Biological Fluidized-Bed Treatment for BOD
and Nitrogen Removal,
W77-09873 5D

BOD5 Removal from Aerated Lagoon Systems,
W77-09913 5D

BIOCIDES

Research and Development of an Elec-
trochemical Biocide, Final Report,
W77-09771 5D

BIODEGRADATION

Study of the Decomposition of Organic Matter
by the Respirometric Dilution Method
(Untersuchungen ueber das Abbauverhalten or-
ganischer Stoffe mit Hilfe der
respirometrischen Verduennungsmethode),
W77-09888 5D

BIOINDICATORS

Water System Virus Detection,
W77-09636 5A

Steroids as Sewage Specific Indicators in New
York Bight Sediments,
W77-09901 5A

The Case for the Expanded Study of Fresh-
water Pollution Zoology,
W77-10086 5C

Dehydration of Marine Zoological Material -
Volatility of Metabolised Selenium at 105-120C,
W77-10095 5A

BIOLOGICAL COMMUNITIES

Ecological Responses of Phytoplankton on
Chronic Oil Pollution,
W77-09674 5C

Analysis of Data from Biological Surveys of
Streams: Diversity and Sample Size,
W77-09778 5A

BIOLOGICAL TREATMENT

Treating Wood Preserving Plant Wastewater by
Chemical and Biological Methods,
W77-09759 5D

Water Purifying Systems,
W77-09808 5F

Nitrogen Control: Design Considerations for
Supported Growth Systems,
W77-09848 5D

Waste Purification Process.
W77-09865 5D

Biological Fluidized-Bed Treatment for BOD
and Nitrogen Removal,
W77-09873 5D

BIOMASS

Relation Between the Kinetics of Nitrogen
Transformation and Biomass Distribution in a
Soil Column During Continuous Leaching,
W77-09973 2G

BIRD EGGS

Histopathologic Alterations in Shell Gland Ac-
companying DDT-Induced Thinning of
Eggshell,
W77-09673 5C

BLEACHING WASTES

Characterization of Spent Bleaching Liquors.
Part 1, Spent Liquors from the Chlorine and
Alkali Extraction Stages in the Prebleaching of
Fine Kraft Pulp,
W77-09731 5A

BOD REMOVAL

BOD5 Removal from Aerated Lagoon Systems,
W77-09913 5D

BOGS

Influences of Some Peat Soil Features on the
Capillary Water Supply, (In German),
W77-09626 2G

BORON

Effects of Boron and Nitrogen on Grain Yield
and Boron and Nitrogen Concentrations of Bar-
ley and Wheat,
W77-09655 3F

BOTTOM MIXING LAYERS

The Bottom Mixed Layer on the Continental
Shelf,
W77-09948 2L

BOTTOM SEDIMENTS

Macrophyte-Sediment Relationships in Chau-
taugua Lake,
W77-09612 5C

The Role of Humic Acids in the Uptake and
Release of Mercury by Freshwater Sediments,
W77-09615 5B

BREAKWATERS

Stability of Rubble-Mound Breakwater Jubail
Harbor, Saudi Arabia; Hydraulic Model In-
vestigation,
W77-09984 8B

Igloo Wave Absorber Tests for Port Washing-
ton Harbor, Wisconsin; Hydraulic Model In-
vestigation,
W77-09990 8B

BRISTOL CHANNEL (WALES)

The Effect of Coastal Hydrodynamics on the
Echinoderm Distribution in the Sublittoral of
Oxwich Bay, Bristol Channel,
W77-09944 2L

BRITISH COLUMBIA

The Effect of Exchange Reactions Between
Fraser River Sediment and Seawater on Dis-
solved Cu and Zn Concentrations in the Strait
of Georgia,
W77-09707 2L

Interactions Between Zinc and Suspended
Sediments in the Fraser River Estuary, British
Columbia,
W77-09949 5B

BROOK TROUT

Effects of Aroclor (R) 1254 on Brook Trout,
Salvelinus Fontinalis,
W77-09783 5C

SUBJECT INDEX

BROWN TROUT

BROWN TROUT

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.),
W77-09672 5C

BULK DENSITY

The Nature of Changes in Bulk Density with Water Contents in Cracking Clay,
W77-09937 2G

CACHE VALLEY (UTAH)

The Functional and Aesthetic Uses of Two Cache Valley, Utah, Canals,
W77-09796 6B

CADMIUM

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of Cd by Montmorillonite,
W77-09658 5B

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L.,
W77-09666 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report,
W77-09763 5C

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments,
W77-09767 5B

Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species,
W77-09784 5C

Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments,
W77-09962 2G

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus,
W77-09977 2G

CAIRO (ILL)

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation,
W77-10043 8B

CAISSONS

Underwater Habitats for Scientific Research in the Great Lakes,
W77-10060 7B

CALCAREOUS SOILS

Ammonia Volatilization from Surface Applications of Ammonium Compounds on Calcareous Soils: V. Soil Water Content and Method of Nitrogen Application,
W77-09960 2G

The Influence of Cation Exchange Capacity and Depth of Incorporation on Ammonia Volatilization from Ammonium Compounds Applied to Calcareous Soils,
W77-09961 2G

CALCIUM

Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates,
W77-09637 3F

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol,
W77-09662 5C

Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments,
W77-09962 2G

CALCIUM CARBONATE

Calcium Carbonate Formation by Enteromorpha Nana Algae in a Hypersaline Volcanic Crater Lake,
W77-09787 2H

CALCIUM CARBONATES

Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics,
W77-10087 5F

CALIFORNIA

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function,
W77-09933 2A

Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design,
W77-10016 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project,
W77-10040 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill),
W77-10041 8B

Los Angeles Harbor Numerical Analysis of Harbor Oscillations,
W77-10042 8B

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California,
W77-10063 5C

CANADA

Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species,
W77-09607 5C

Methane Oxidation in a Eutrophic Canadian Shield Lake,
W77-09608 5C

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada,
W77-09617 5C

Competition for Mercury Between River Sediment and Bacteria,
W77-09661 5B

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate,
W77-09664 5C

Short Term Variability in Vertical Chlorophyll Structure,
W77-09702 2L

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dis-

solved Cu and Zn Concentrations in the Strait of Georgia,
W77-09707 2L

Closed-Cycle Mill Eliminates Pollution While Also Saving Money,
W77-09740 3E

A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters,
W77-09794 5C

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia,
W77-09949 5B

CANAL FLUSHING

Flushing Characteristics of a Mississippi Dead-End Canal System,
W77-09721 5B

CANALS

Flushing Characteristics of a Mississippi Dead-End Canal System,
W77-09721 5B

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation,
W77-10047 8B

CAPILLARY WATER

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German),
W77-09626 2G

CARASSIUS

Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation,
W77-09779 5C

CARBARYL

Movement of Carbaryl Through Congaree Soil into Ground Water,
W77-09976 5B

CARBON

Continuous On-Line Monitoring of Total Organic Carbon,
W77-09635 5A

Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers,
W77-09904 5A

Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater,
W77-09917 5B

Parameters which Influence the Organic Carbon Determination in Water,
W77-10092 5A

CARBON DIOXIDE

Analysis of the Population Dynamics of Oscillatoria Redkei Van Goor in Lake Edeberg,
W77-09629 5C

Influence of Certain Water Conditions, Especially Dissolved Gasses, on Trout,
W77-09790 5C

Waste Water Biochemical Purification Control--By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution.
W77-09845 5D

SUBJECT INDEX

CHINOOK SALMON

- CARLYLE LAKE (ILL.)**
Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation, W77-09943 4A
- CARSON RIVER BASIN (WESTERN NEV.)**
Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A
- CATALYSTS**
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B
- CATALYTIC DEOXYGENATION**
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B
- CATALYTIC KINETICS**
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B
- CATFISHES**
Productivity of Clarias Batrachus in the Sewage Fertilized Fish Ponds, W77-09922 5C
- CATION ABSORPTION (PLANTS)**
Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F
- CATION ADSORPTION**
Influence of Cation Content on the Biological Activity of Fensulfthion in Plainfield Sand, W77-09639 2G
- CATION EXCHANGE**
Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G
The Influence of Cation Exchange Capacity and Depth of Incorporation on Ammonia Volatilization from Ammonium Compounds Applied to Calcareous Soils, W77-09961 2G
Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter, W77-09971 2G
Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G
- CATIONS**
Influence of Cation Content on the Biological Activity of Fensulfthion in Plainfield Sand, W77-09639 2G
- CAVITATION**
Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B
- CELL LYSIS**
Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C
- CELTIC SEA**
A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L
- The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L
- CENTER SLUICE INVESTIGATIONS**
Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B
- CENTRAL IDAHO BATHOLITH**
The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I
- CHANNEL CATFISH**
Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C
Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C
- CHANNEL DEEPENING**
Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B
- CHANNEL EROSION**
Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England, W77-09700 2J
- CHANNEL FLOW**
Critical and Brink Depths in Elliptical Sewers, W77-09841 8B
- CHANNEL IMPROVEMENT**
Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, W77-09988 8B
Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B
- CHANNEL MORPHOLOGY**
The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill, W77-09950 2J
Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E
- CHANNELS**
Brink Depth Method in Rectangular Channel, W77-09695 8B
- CHARLESTON HARBOR (SC)**
Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B
- CHAUTAUGUA LAKE (NY)**
Macrophyte-Sediment Relationships in Chautaugua Lake, W77-09612 5C
- CHELATE ABSORPTION (PLANTS)**
Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F
- CHELATION**
Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F
- CHEMICAL ANALYSIS**
Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A
Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A
- CHEMICAL DEGRADATION**
Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F
- CHEMICAL OXYGEN DEMAND**
Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A
- CHEMICAL PRECIPITATION**
Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics, W77-10087 5F
- CHEMICAL REACTIONS**
Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F
Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D
- CHEMICAL TREATMENT**
Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D
Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D
- CHEMICAL TREATMENT (SEWAGE)**
Chemical Treatment of Sewage, W77-09892 5D
- CHEMISTRY OF PRECIPITATION**
An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C
- CHESAPEAKE BAY**
Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L
- CHILE**
The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A
- CHINOOK SALMON**
The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I

SUBJECT INDEX

CHINOOK SALMON

CHIPUXET AQUIFER (RI)

An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, W77-09637 2F

CHLORAMINE

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

CHLORIDES

Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

CHLORINATED HYDROCARBON

A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A

CHLORINATED HYDROCARBON PESTICIDES

The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), W77-09675 5C

Organchlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

CHLORINATION

Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

Nitrification in a Chlorinated Activated Sludge Culture, W77-09851 5D

CHLORINE

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

CHLOROPHYLL

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

Short Term Variability in Vertical Chlorophyll Structure, W77-09702 2L

CHROMATOGRAPHY

Standardization of Methylmercury Analysis, W77-09775 5A

CHROMIUM

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

CHUTES

Convex Chutes in Converging Supercritical Flow, W77-10020 8B

CHYDORIDAE

The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H

CIRCULATION

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L

Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

CLADOPHORA

An Investigation of the Nearshore Region of Lake Ontario IFYGL, W77-10053 5C

CLAY SEDIMENTS

Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

CLAYS

Adsorption of Dodecylbenzene Sulfonate on NA(+)-Montmorillonite: Effect of Salt Impurities, W77-09651 2G

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of CD by Montmorillonite, W77-09658 5B

Nirmali Seed--A Naturally Occurring Coagulant, W77-09861 5D

The Nature of Changes in Bulk Density with Water Contents in Cracking Clay, W77-09937 2G

Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments, W77-09962 2G

Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G

CLEAR CUTTING

The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire, W77-09807 4C

CLEAR LAKE (CALIF)

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C

CLIMATIC DATA

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

CLIMATOLOGY

Temporally and Areally Distributed Rainfall, W77-09696 2B

CLOUD PHYSICS

Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements, W77-09720 2B

Ice Nucleation by Micas, W77-09956 2B

CLOUD SEEDING

Ice Nucleation by Micas, W77-09956 2B

CLOUDS

Acceleration to Terminal Velocity of Cloud and Raindrops, W77-09719 2B

CO2 UPTAKE

Effect of Increasing Foliage Reflectance on the CO2 Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

COAGULATION

Nirmali Seed--A Naturally Occurring Coagulant, W77-09861 5D

Character and Dewatering Properties of Sludges from Water Treatment, W77-09881 5D

Zeta Potential Measurement, W77-09908 5A

COASTAL ZONE MANAGEMENT

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

COASTS

Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L

Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L

The Georgia Coastal Environment. A Compilation of Resource Materials Covering the Coastal Plain, Estuaries and Offshore Waters. W77-10025 2L

SUBJECT INDEX

CORPUS CHRISTI PASS (TEX)

COBALT

- Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B

COCKFIELD FORMATION (MISS)

- The Cockfield Aquifer in Mississippi, W77-09991 7C

COHO SALMON

- Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C
- Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

COLOR

- Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L

COLORADO

- Precipitation Trend and Storm Analysis in Colorado, W77-09685 2C
- Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B

COLORADO RIVER BASIN

- Colorado River Basin Salinity Control Project--Title I, W77-09931 5D

COMBINED SEWER OVERFLOWS

- Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D

COMBINED SEWERS

- Urban Runoff Pollution Control--Technology Overview, W77-09823 5D
- Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D
- Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D

COMMUNITY DEVELOPMENT

- Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C

COMPARATIVE COSTS

- Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C

COMPETITION

- The Effect of Copper on Competition Between Marine Algae, W77-10051 5C

COMPOSTED SLUDGE

- Inactivation by Ionizing Radiation of Salmonella Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D

COMPOSTING

- Continuous Composting of Organic W W Waste--by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E

COMPOSTING (SOLID WASTES)

- Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

COMPUTER MODELS

- An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, W77-09637 2F

- Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation, W77-09943 4A

- Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B

- Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

COMPUTER PROGRAMS

- Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A

COMPUTERS

- Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

CONCRETE STRUCTURES

- PVC Lining--The Answer to Corrosive Attack by H2S in Concrete Sewers and Structures, W77-09835 8G

CONCRETE TECHNOLOGY

- Synthetic Aggregates Made from Sewage Plant Sludge, W77-09924 8F

CONSTRUCTION

- Pennsylvania Waste Water Project Progresses Quickly, W77-09840 5D
- Construction Management for Waste Water-treatment Plants, W77-09920 5D

CONTINENTAL SHELF

- Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L
- The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L
- Identification and Analysis of Mid-Atlantic Onshore OCS Impacts, W77-10027 5C

CONTINUOUS FILTER PRESS

- Continuous Filter Press, W77-09826 5D

CONTINUOUS FLOW

- The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

CONTINUOUS POLLUTANT EXPOSURE

- Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

CONTROL

- Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D

CONTROL STRUCTURES

- Computation of Records of Streamflow at Control Structures, W77-10003 2E
- Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B

COOLING WATER

- How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

COPPER

- Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F

- The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

- Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

- Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

- Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

- The Effect of Copper on Competition Between Marine Algae, W77-10051 5C

CORES

- A Simple Hand Corer for Shallow Water Sampling, W77-09715 7B

CORN (FIELD)

- Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F

- Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D

CORPUS CHRISTI PASS (TEX)

- Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

SUBJECT INDEX

CORROSION CONTROL

CORROSION CONTROL

Corrosion Avoidance in Water and Sewage
Pipelines, W77-09832 8F

PVC Lining--The Answer to Corrosive Attack
by H₂S in Concrete Sewers and Structures.
W77-09835 8G

COST ALLOCATION

Impact of Municipal Water and Sewage
Charges on Industry, W77-09921 5G

COSTS

Closed-Cycle Mill Eliminates Pollution While
Also Saving Money, W77-09740 3E

Low Cost Phosphorus Removal at Reno-
Sparks, Nevada, W77-09849 5D

The Day They Almost Abandoned the Orange-
Fish Tunnel, W77-10077 8A

CRANCON

The Toxicity of Sodium Pentachlorophenolate
for Three Species of Decapod Crustaceans and
Their Larvae, W77-09663 5C

CRICKETS

Influence of Cation Content on the Biological
Activity of Fensulfothion in Plainfield Sand,
W77-09639 2G

CRITICAL DEPTH

Brink Depth Method in Rectangular Channel,
W77-09695 8B

CRITICAL FLOW

Brink Depth Method in Rectangular Channel,
W77-09695 8B

CROP PRODUCTION

Influence of Long Term Tillage, Crop Rotation,
and Soil Type Combinations on Corn Yield,
W77-09969 3F

CROP RESPONSE

Sulfur-Coated Fertilizers for Sugarcane: I.
Plant Response to Sulfur-Coated Urea,
W77-09640 3F

Evaluation of the Parameters of Soil
Phosphorus Availability Factors in Predicting
Yield Response and Phosphorus Uptake,
W77-09646 2G

Crop Temperature Modification and Yield
Potential in a Dwarf Spring Wheat,
W77-09939 3F

CRUDE OIL

Continuous-Flow Apparatus for Use in Petroleum
Bioassay, W77-09681 5A

CRUSTACEANS

The Toxicity of Sodium Pentachlorophenolate
for Three Species of Decapod Crustaceans and
Their Larvae, W77-09663 5C

Accommodation of *Daphnia pulex* to Altered pH
Conditions as Measured by Feeding Rate,
W77-09678 5C

The Ecology of Chydoridae (Cladocera) of
Lake Baikal (In Russian), W77-10064 2H

CULTIVATION

Influence of Long Term Tillage, Crop Rotation,
and Soil Type Combinations on Corn Yield,
W77-09969 3F

CULVERTS

Impact of Economic Risks on Box Culvert
Designs--An Application to 22 Virginia Sites,
W77-10067 8B

CURRENTS (WATER)

A Model of Dynamics in the Lower Potomac
River Estuary, W77-09714 2L

CYANIDE

Detoxification of Aqueous Waste Streams Con-
taining Cyanide, W77-09812 5D

CYANOPHYTA

Ecological Responses of Phytoplankton on
Chronic Oil Pollution, W77-09674 5C

The Effect of Wind on the Distribution of
Chlorophyll A and Crustacean Plankton in a
Shallow Eutrophic Reservoir, W77-09679 5B

CYCLING NUTRIENTS

Nutrient Diversion: Resulting Lake Trophic
State and Phosphorus Dynamics, W77-09604 5G

Studies on the Reclamation of Stone Lake,
Michigan, W77-09605 5G

CYCLOHEXANE

Investigation of Selected Potential Environ-
mental Contaminants: Ketonic Solvents,
W77-09770 5B

CYTOLOGICAL STUDIES

Toxic Action of Several Lethal Concentrations
of an Anionic Detergent on the Gills of the
Brown Trout (*Salmo trutta* L.), W77-09672 5C

DACE

Immediate Behavioral Reactions of Blacknose
Dace, *Rhinichthys atratulus*, to Domestic
Sewage and its Toxic Constituents, W77-09669 5C

DAM CONSTRUCTION

Through the Andes, W77-09687 8A

DAM FAILURE

The Dam Busters, W77-10070 8A

DAPHNIA

Accommodation of *Daphnia pulex* to Altered pH
Conditions as Measured by Feeding Rate,
W77-09678 5C

Filtering Rate Inhibition of *Daphnia pulex* in
Wintergreen Lake Water, W77-09910 5C

DATA COLLECTIONS

Satellite-Derived Global Oceanic Rainfall Atlas
(1973 and 1974), W77-09693 7C

Sensitivity Analysis of the Water Quality for
River-Reservoir Systems Model, W77-09981 5B

Discharge Data at Water-Quality Monitoring
Stations in Arkansas, 1976 Water Year,
W77-09997 7C

Water Quality Program of the U.S. Geological
Survey, W77-10006 5A

Federal Plan for Acquisition of Water Data by
Federal Agencies, Fiscal Year 1977.
W77-10013 7C

DATA STORAGE AND RETRIEVAL

Method of Analyzing Some Experimental Data
on Zooplankton, (In Russian), W77-10038 2I

DDE

Organochlorine Pesticides and PCBs Distribu-
tion in Tissues of Purple Heron and Spoon
Duck from the Biological Reserve of Donana
(Spain), W77-09677 5A

DDT

Histopathologic Alterations in Shell Gland Ac-
companying DDT-Induced Thinning of
Eggshell, W77-09673 5C

Organochlorine Pesticides and PCBs Distribu-
tion in Tissues of Purple Heron and Spoon
Duck from the Biological Reserve of Donana
(Spain), W77-09677 5A

DECAPOD CRUSTACEANS

The Toxicity of Sodium Pentachlorophenolate
for Three Species of Decapod Crustaceans and
Their Larvae, W77-09663 5C

DECOMPOSING ORGANIC MATTER

Petroleum Hydrocarbons: Degradation and
Growth Potential of Deep-Sea Sediment Bac-
teria, W77-09772 5C

DEEP DISTRIBUTARY CHANNELS

Deep Distributary Channels and Giant
Bedforms in the Upper Carboniferous of the
Central Pennines, Northern England,
W77-09700 2J

DEEP WATER

Dilution Characteristics of Effluents in Deep
Water Reservoirs Determined with a Radioac-
tive Indicator (On the Example of Lake
Baikal), (In Russian), W77-09735 5B

DEFORMITIES (FISH)

Temperature Effects on Young Yellow Perch,
Perca flavescens (Mitchill), W77-09773 5C

DEGRADATION (DECOMPOSITION)

Evaluation of a Laboratory Microcosm for
Study of Toxic Substances in the Environment:
Final Technical Report, July 1, 1973-December
31, 1975, W77-09769 5A

DEGRADATION PATHWAYS

Evaluation of a Laboratory Microcosm for
Study of Toxic Substances in the Environment:
Final Technical Report, July 1, 1973-December
31, 1975, W77-09769 5A

SUBJECT INDEX

DISSOLVED OXYGEN

DEHYDRATION

Dehydration of Marine Zoological Material - Volatility of Metabolised Selenium at 105-120C, W77-10095 5A

DELTAS

Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L

DENITRIFICATION

Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species, W77-09607 5C

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation, W77-09643 2G

Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil, W77-09653 5B

Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B

Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils, W77-09966 5B

DENSITY

Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L

DESALINATION

Distillation Apparatus and Method, W77-09804 3A

Semipermeable Membranes and the Method for the Preparation Thereof, W77-09817 3A

Colorado River Basin Salinity Control Project-- Title I, W77-09931 5D

DESALINATION PLANTS

Application of Membrane Processes, W77-09929 3A

DESALINATION PROCESSES

Regular Copolyamides as Desalination Membranes, W77-09806 3A

Application of Membrane Processes, W77-09929 3A

DESIGN

Aeration: Proper Sizing is Critical, W77-09905 5D

Analysis of Economic Sewage Lift Station Design, W77-09906 8C

DESIGN CRITERIA

Design and Operation of Rain Spillways and Rain Overflow Catchment (Entwurf und Betrieb von Regenüberläufen (Ru) und Regenüberlaufbecken (RUB)), W77-09822 8B

Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D

New Sewer System Resists Infiltration.

W77-09843 5D

Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D

How Sludge Characteristics Affect Incinerator Design, W77-09869 5E

Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D

Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D

Impact of Economic Risks on Box Culvert Designs--An Application to 22 Virginia Sites, W77-10067 8B

DESIGN WAVE HEIGHTS

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie, W77-09986 8B

DETERGENTS

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

DEWATERING

Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect, W77-09737 5E

Character and Dewatering Properties of Sludges from Water Treatment, W77-09881 5D

DIALYSIS

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

DIATOMS

Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C

Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), W77-09620 2I

Diatoms in Pond Plankton: Relationships to Epiphytic and Epipellic Populations, W77-09628 5C

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

DICALCIUM PHOSPHATE

Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G

DICKEY-LINCOLN SCHOOL LAKES (ME)

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

DIELDRIN

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

DIETS

Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish), W77-10066 2L

DIFFERENTIAL SCANNING CALORIMETRY

A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

DIFFUSION

Simulation Factors Involved in Ocean Thermal Power Plants, W77-10034 5B

DINOFLAGELLATES

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

DIPTERA

Studies on the Bottom Fauna of Four Lakes in Eastern Hokkaido (Lakes Kusshyaro-Ko, Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In Japanese), W77-10028 5C

DISCHARGE COEFFICIENT

Computation of Records of Streamflow at Control Structures, W77-10003 2E

DISCHARGE MEASUREMENT

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year, W77-09997 7C

DISINFECTION

Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D

Photodynamic Inactivation of Infectious Agents, W77-09883 5D

DISPERSED PETROLEUM DERIVATIVES

Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A

DISSOLVED OXYGEN

Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B

The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C

Influence of Certain Water Conditions, Especially Dissolved Gases, on Trout, W77-09790 5C

SUBJECT INDEX

DISSOLVED OXYGEN

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, W77-09792 5C

Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C

Studies on the Bottom Fauna of Four Lakes in Eastern Hokkaido (Lakes Kussharo-Ko, Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In Japanese), W77-10028 5C

Bay Springs Lake Water-Quality Study, W77-10055 5B

DISSOLVED SOLIDS

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B

DISTILLATION

Distillation Apparatus and Method, W77-09804 3A

DISTRIBUTION

Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS, W77-09659 5B

The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I

Relation Between the Kinetics of Nitrogen Transformation and Biomass Distribution in a Soil Column During Continuous Leaching, W77-09973 2G

DISTRIBUTION PATTERNS

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H

DISTRIBUTION SYSTEMS

Grove Irrigation System, W77-09800 3F

DIVERSION

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B

DIVING EQUIPMENT

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

DOMESTIC WASTES

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

Gravitational Separator, W77-09821 5D

DRAINAGE

Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian), W77-09630 3C

A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G

Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanalen und-leitungen), W77-09833 8G

DRAINAGE SYSTEMS

1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A

Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B

DRAINAGE WATER

Effect of Leaching Fraction on River Salinity, W77-09697 5G

DRAINING SLOPES

A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G

DRAINS

Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian), W77-09630 3C

Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

DRAKENSBURG

Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D

DREDGE SPOILS

Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil, W77-10035 2L

DREDGING

A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

DROUGHTS

Arid Lands of Sub-Saharan Africa, W77-09934 6E

DUCKS (WILD)

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

DUNE SANDS

Stabilization of Sand Dunes in the West Sahara, W77-10074 4A

DYES

Characterization and Treatment of Textile Dyeing Wastewaters, W77-09745 5D

Photodynamic Inactivation of Infectious Agents, W77-09883 5D

DYNAMIC PROGRAMMING

Optimal Operation of Flood Control Systems, (Final Report; V.II), W77-09927 4A

DYNAMICS

A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L

EARTH DAMS

Seepage from Small Earth Dams, W77-09932 8D

EARTHQUAKES

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

ECHINODERMS

The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel, W77-09944 2L

ECOLOGY

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H

Environmental Sciences, W77-10098 6G

ECONOMIC EFFICIENCY

Application of Membrane Processes, W77-09929 3A

Impact of Economic Risks on Box Culvert Designs--An Application to 22 Virginia Sites, W77-10067 8B

ECONOMICS

Relationship of Effluent Limitations to Future Pulp Mill Closures, W77-09727 5D

ECOSYSTEMS

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

SUBJECT INDEX

ESTIMATING

- Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model, W77-09981 5B
- The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C
- Environmental Sciences, W77-10098 6G
- ECTOTYPES**
Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H
- EDTA**
Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C
- EFFLUENTS**
Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A
- EGGSHELLS**
Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C
- EL VADO LAKE (NM)**
Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J
- ELECTRIC POWER COSTS**
Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D
- ELECTROCHEMICAL BIOCIDES**
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
- ELECTROCHEMISTRY**
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
- ELECTROLYSIS**
Water Treatment System with Prolonged Aeration, W77-09818 5G
- ELECTRON MICROSCOPY**
Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C
- ELECTRON PARAMAGNETIC RESONANCE**
Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K
- ELECTROOXIDATION**
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
- ELEFSIS BAY (AEGEAN SEA)**
Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C
- ELLIPTICAL SEWERS**
Critical and Brink Depths in Elliptical Sewers, W77-09841 8B
- ENERGY**
Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D
- ENERGY BUDGET**
An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C
- ENGLAND (UPPER CARBONIFEROUS)**
Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England, W77-09700 2J
- ENGLISH CHANNEL**
The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L
- ENTRAINMENT**
Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L
- ENTRAINMENT VELOCITY**
Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L
- ENVIRONMENTAL CONTROL**
Cross Canada Report, W77-09923 5G
- ENVIRONMENTAL EFFECTS**
Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975, W77-09769 5A
- Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C
- Water Resources Assessment Methodology (WRAM)--Impact Assessment and Alternative Evaluation, W77-09985 6G
- Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C
- Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, W77-10029 2L
- Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C
- Environmental Sciences, W77-10098 6G
- Lake Sibaya - A Land-Locked Estuary, W77-10099 2H
- ENVIRONMENTAL FATE**
Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975, W77-09769 5A
- ENVIRONMENTAL HAZARDS**
Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B
- ENVIRONMENTAL IMPACT**
Identification and Analysis of Mid-Atlantic Onshore OCS Impacts, W77-10027 5C
- ENVIRONMENTAL IMPACT ASSESSMENT**
Water Resources Assessment Methodology (WRAM)--Impact Assessment and Alternative Evaluation, W77-09985 6G
- EPHEMERAL STREAMS**
The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill, W77-09950 2J
- EPILITHIC PERIPHYTON**
A Practical Apparatus for Quantitative Sampling of Epilithic Periphyton, (In French), W77-09623 7B
- EQUATIONS**
On Penman's Equation for Estimating Regional Evaporation, W77-09953 2D
- Computation of Records of Streamflow at Control Structures, W77-10003 2E
- EQUIPMENT**
A Simple Hand Corer for Shallow Water Sampling, W77-09715 7B
- Waste Water Biochemical Purification Control--By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution, W77-09845 5D
- Bottom Withdrawal can Enhance Lake Water Quality, W77-10049 5G
- Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B
- EROSION**
Matting for the Prevention of Hydraulic Erosion, W77-09798 4D
- Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L
- The Causes of Erosion to Siletz Spit, Oregon, W77-10039 2L
- EROSION CONTROL**
Matting for the Prevention of Hydraulic Erosion, W77-09798 4D
- Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D
- ESTIMATING**
Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

SUBJECT INDEX

ESTIMATING

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

On Penman's Equation for Estimating Regional Evaporation, W77-09953 2D

Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

ESTUARIES

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L

A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei osenbusshitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosoku-moderu no kaihatsu ni kansuru kenkyu), W77-09911 5B

Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L

Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

The Georgia Coastal Environment. A Compilation of Resource Materials Covering the Coastal Plain, Estuaries and Offshore Waters. W77-10025 2L

Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L

A Dynamic Water Quality Model for the Neuse Estuary, N.C., W77-10037 5B

Oligochaeta of the Deniester River Mouth Region, (In Russian), W77-10065 2L

ESTUARINE ENVIRONMENT

A Check List and Notes on the Birds of Sandvics, South West Africa, W77-10089 2L

ESTUARINE GEOCHEMISTRY

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

ESTUARY

A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L

EUTROPHICATION

Studies on the Reclamation of Stone Lake, Michigan, W77-09605 5G

Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

Environmental Status of the Lake Michigan Region: Vol. 4. Phytoplankton of Lake Michigan, W77-10056 5C

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase 1, W77-10061 5C

EVALUATION

A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A

Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D

Water Resources Assessment Methodology (WRAM)—Impact Assessment and Alternative Evaluation, W77-09985 6G

Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota. W77-10062 5C

EVAPORATION

Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe, W77-09710 2D

A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlmon, Central Wales, W77-09711 2D

On Penman's Equation for Estimating Regional Evaporation, W77-09953 2D

Evaporation from a Warm, Wavy Surface: A Laboratory Study, W77-09954 2D

EVAPORATION RATES

Evaporation from a Warm, Wavy Surface: A Laboratory Study, W77-09954 2D

EVAPOTRANSPIRATION

Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D

EVERGREEN SHRUBS

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

EXOPHTHALMIA

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, W77-09792 5C

EXPERIMENTAL LAKES AREA (CANADA)

Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species, W77-09607 5C

Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C

EXPLORATION

Electrical Water Prospecting, W77-10100 2F

FARM WASTES

Application of the Rotating Flighted Cylinder to Livestock Waste Management, W77-09795 5D

Agricultural Wastes in Fish Farming. A Commercial Application of the Culture of Single-Celled Organisms for Protein Production, W77-10050 5E

FEASIBILITY STUDIES

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

FEEDING RATES

Accommodation of Daphnia pulex to Altered pH Conditions as Measured by Feeding Rate, W77-09678 5C

FEN

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

FENSULFOTHION

Influence of Cation Content on the Biological Activity of Fensulfuthion in Plainfield Sand, W77-09639 2G

FERMENTATION

Fermentation Technology, W77-09896 5D

FERRIC CHLORIDE

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

FERTILIZATION

Sulfur-Coated Fertilizers for Sugarcane: I. Plant Response to Sulfur-Coated Urea, W77-09640 3F

Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KCl, W77-09641 3F

Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers, W77-09642 3F

SUBJECT INDEX

FISH PHYSIOLOGY

FERTILIZERS

Sulfur-Coated Fertilizers for Sugarcane: I. Plant Response to Sulfur-Coated Urea, W77-09640 3F

Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KC1, W77-09641 3F

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation, W77-09643 2G

Pasteur v Curie, W77-09864 5D

Elemental Composition of Sludge-Fertilized Chrysanthemums, W77-09868 5E

A New Rapid Digestion Process for Sewage Sludge Utilization (Einneues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klaufschlamm-Verwertung), W77-09887 5D

Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers, W77-09904 5A

Options for Sludge--To Land, Sea or Fire, W77-09918 5E

FIBER MATTING (EROSION CONTROL)

Matting for the Prevention of Hydraulic Erosion, W77-09798 4D

FIELDS LAKE (TEXAS)

Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C

FILTERS

Continuous Filter Press, W77-09826 5D

Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D

Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D

New Wastewater Treatment Systems, W77-09886 5D

FILTRATION

Liquid Filtering Apparatus, W77-09820 5D

Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D

Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D

Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D

Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal, W77-09873 5D

Character and Dewatering Properties of Sludges from Water Treatment, W77-09881 5D

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

FINITE ELEMENT ANALYSIS

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B

Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

FINLAND

Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

FISH

The Consequences of Impoundment on an Arctic Char Lake System. An Analysis by Simulation Modelling, W77-09616 5B

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C

FISH BEHAVIOR

The Effect of Tricaine Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, W77-09792 5C

FISH BLOOD

The Effect of Tricaine Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

FISH DISEASES

The Effect of Tricaine Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

Temperature Effects on Young Yellow Perch, *Perca flavescens* (Mitchill), W77-09773 5C

FISH FARMING

Agricultural Wastes in Fish Farming. A Commercial Application of the Culture of Single-Celled Organisms for Protein Production, W77-10050 5E

FISH FOOD ORGANISMS

Agricultural Wastes in Fish Farming. A Commercial Application of the Culture of Single-Celled Organisms for Protein Production, W77-10050 5E

FISH HATCHERIES

How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

FISH LAKE (TEXAS)

Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C

FISH MANAGEMENT

A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model, W77-09631 5C

Productivity of *Clarias batrachus* in the Sewage Fertilized Fish Ponds, W77-09922 5C

The Shore and the Water-The Localization of Damage and the Regulation of Fish Management in Controlled Lakes, (In Swedish), W77-09935 4A

The Darwendale Reservoir as a Fishery, W77-10096 2H

FISH PARASITES

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

Urceolarids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian), W77-09936 2H

FISH PHYSIOLOGY

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C

SUBJECT INDEX

FISH PHYSIOLOGY

Influence of Certain Water Conditions, Especially Dissolved Gases, on Trout, W77-09790 5C

How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

FISH POPULATIONS

Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

FISH REPRODUCTION

Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

FJORDS

Deep Water Renewal and Associated Processes in North Norway, W77-09947 2L

FLAX POND MARSH (NY)

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

FLOCCULATION

Nirmali Seed—A Naturally Occurring Coagulant, W77-09861 5D

Zeta Potential Measurement, W77-09908 5A

Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G

Clarifier for Underground Use, W77-10081 5D

FLOOD CONTROL

Chicago Plan Designed for Pollution and Flood Control, W77-09838 4A

Optimal Operation of Flood Control Systems, (Final Report; V.II), W77-09927 4A

FLOOD DAMAGE

Impact of Economic Risks on Box Culvert Designs—An Application to 22 Virginia Sites, W77-10067 8B

FLOOD FORECASTING

Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve Flood-Frequency Estimates on Small Tennessee Streams, W77-10004 2A

Small Catchment Flood Modelling, W77-10083 2E

FLOOD FREQUENCY

Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve

Flood-Frequency Estimates on Small Tennessee Streams, W77-10004 2A

FLOODED SOILS

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

FLOODS

Temporally and Areally Distributed Rainfall, W77-09696 2B

FLORIDA

Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

Fluctuations of Ground-Water Levels in Lee County, Florida, in 1975 Water Year, W77-10014 2F

FLORIDA STRAITS

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

FLOTATION

Microflotation in Effluent Purification (Mikroflotation in der Abwasseraufbereitung), W77-09899 5D

FLOW

The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation, W77-10043 8B

Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

FLOW CHARACTERISTICS

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation, W77-10043 8B

FLOW RATES

Critical and Brink Depths in Elliptical Sewers, W77-09841 8B

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year, W77-09997 7C

Computation of Records of Streamflow at Control Structures, W77-10003 2E

FLOWMETERS

Acoustical Wave Flowmeter, W77-09809 7B

FLUIDIZED-BED TREATMENT

Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal, W77-09873 5D

FLY ASH ABSORPTION

Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

FOLIAGE REFLECTANCE

Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

FOOD ABUNDANCE

Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish), W77-10066 2L

FOOD PROCESSING INDUSTRY

Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C

FOOD WEBS

A Food Web Model for Lake Michigan: Part I. Justification and Development of the Model, W77-09631 5C

FORECASTING

Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C

FOREST MANAGEMENT

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality, W77-09756 5G

The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire, W77-09807 4C

FOREST WATERSHEDS

A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

FORESTS

A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

FOULING

Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides, W77-10059 4A

FOUNDATION FAILURE

The Dam Busters, W77-10070 8A

FRANCE

Fiberboard Mill Recycles Water, W77-09728 5D

FRASER RIVER

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

SUBJECT INDEX

GROUNDWATER

FRESHWATER

The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

FRESHWATER FISH

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C

Further Important Features of the Fish Fauna of the Clanwilliam Olifants River System, Southwestern Cape, W77-10090 2E

FRESHWATER INFLOW

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

FRESHWATER MUSSELS

The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

FRUIT CROPS

Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D

FUCUS

Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

FUEL SPILL COLLECTION

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

FUEL SPILL NEUTRALIZATION

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

FUEL SPILL PROBLEM

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

FUELS

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D

FULVIC ACIDS

Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F

GAINESVILLE LOCK AND DAM (ALA)

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

GAS BUBBLE DISEASE

Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C

GAS BUBBLE DISEASES

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, W77-09792 5C

GAS CHROMATOGRAPHY

Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A

Determination of Arsenic Species in Natural Waters, W77-09747 5A

Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A

GATE VIBRATION

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

GATES

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

GEARS

Gear Motor Solves Plant's Noise Problem, W77-09827 8C

GEOCHEMISTRY

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

GEORGIA

The Georgia Coastal Environment. A Compilation of Resource Materials Covering the Coastal Plain, Estuaries and Offshore Waters, W77-10025 2L

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal, W77-10029 2L

GILL DAMAGE

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

GLACIAL SEDIMENTS

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

GLACIAL SOILS

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

GLACIERS

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present, W77-09706 2J

GLYCOSIDES (TRITERPENE)

Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I

GORKY HYDROELECTRIC POWERPLANT (USSR)

Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides, W77-10059 4A

GRADIENTS (STREAMS)

Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

GRAIN SORGHUM

Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

GRAVITY THICKENING

Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

GREAT DISMAL SWAMP (NC AND VA)

The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing, W77-10007 2H

GREAT LAKES

A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie, W77-09986 8B

Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

GROUNDWATER

The Fate of Pollutants in Subsurface Environments, W77-09915 5B

Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater, W77-09917 5B

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

Water Resources Data for Ohio, Water Year 1975--Volume 1. Ohio River Basin, W77-10000 7C

SUBJECT INDEX

GROUNDWATER

- Water Resources Data for Ohio, Water Year 1975--Volume 2. St. Lawrence River Basin, W77-10001 7C
- Water Resources Data For Wyoming, Water Year 1975, W77-10002 7C
- Water Quality Program of the U.S. Geological Survey, W77-10006 5A
- Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A
- Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year, W77-10014 2F

GROUNDWATER MOVEMENT

- Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F
- Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B
- A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties, W77-10008 2F

GROUNDWATER RESOURCES

- An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, W77-09637 2F
- The Cockfield Aquifer in Mississippi, W77-09991 7C
- Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B
- Ground-Water Resources of the Lexington, Kentucky, Area, W77-09996 4B
- Selected Water-Level Records for Western Oklahoma, 1975-1976, W77-09998 7C
- Ground-Water Levels in Observation Wells in Oklahoma, 1975, W77-09999 7C
- Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

GROWTH INHIBITION

- Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C

GROWTH RATES

- Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C
- Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C
- Effects of Aroclor (R) 1254 on Brook Trout, *Salvelinus fontinalis*, W77-09783 5C

- Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C

- Simulation of Plant Growth by Humic Substances, W77-09963 2I

GROWTH STAGES

- Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

GULF OF ALASKA

- Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

GULF OF MEXICO

- Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C
- Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C
- Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L

HALIDES

- Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

HALOGENS

- Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

HARBOR IMPROVEMENTS

- Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

HARBOR OSCILLATIONS

- Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B
- Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B
- Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B
- Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B
- Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L
- Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation, W77-09984 8B

HARBORS

- Design for Small-Boat Harbor Improvements; Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

- Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09990 8B

- Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B

- Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

- Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

- Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

- Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B

- Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

HAVEL LAKE (GERMANY)

- Intensive Large City Influence on Reed-Banks, (In German), W77-09621 5C

HAWAII

- Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B

HEAT

- Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil, W77-09654 5D

HEAT PUMP

- How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

HEAT TREATMENT

- Pasteur v Curie, W77-09864 5D

HEATED WATER

- How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C
- Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B
- Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian), W77-10010 5C
- How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

SUBJECT INDEX

HYDROBIONTS

HEAVY METAL GEOCHEMISTRY

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

HEAVY METAL TRANSPORT

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

HEAVY METALS

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

HELMINTHIC INFECTIONS

Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia, W77-10076 5G

HEPATIC ARYL HYDROCARBON

HYDROXYLASE

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

HERBICIDES

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C

Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides, W77-10059 4A

HIGH-GRADIENT STREAMS

Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

HIGHWAYS

Impact of Economic Risks on Box Culvert Designs--An Application to 22 Virginia Sites, W77-10067 8B

HISTOLOGY

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

HOLLOW FIBERS (CELLULOSE-ACETATE)

Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers, W77-09967 2G

HOLOTHURIANS (PACIFIC)

Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I

HOLSTON RIVER (TENN)

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

HUMAN DISEASES

Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia, W77-10076 5G

HUMIC ACIDS

The Role of Humic Acids in the Uptake and Release of Mercury by Freshwater Sediments, W77-09615 5B

HUMUS

An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C

Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A

Simulation of Plant Growth by Humic Substances, W77-09963 2I

HYDRATES

Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G

HYDRAULIC CONDUCTIVITY

Seepage from Small Earth Dams, W77-09932 8D

HYDRAULIC DESIGN

Design Proposals for Submersible Sewage Lift Stations, W77-09839 8C

HYDRAULIC MACHINERY

Sewage Ejectors Avoid Manual Unblocking of Pipes, W77-09856 8C

HYDRAULIC MODELS

Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation, W77-09984 8B

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, W77-09988 8B

Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09990 8B

Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B

North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B

Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B

Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation, W77-10043 8B

Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B

Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

Bay Springs Lake Water-Quality Study, W77-10055 5B

HYDRAULIC STRUCTURES

Design Proposals for Submersible Sewage Lift Stations, W77-09839 8C

HYDRAZINE

Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B

HYDROBIOLOGY

The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

HYDROBIONTS

Effluents of Kraft Mills and Their Toxicity for Hydrobionts (*Stochne vody sul'fat-tsellyuloz-*

SUBJECT INDEX

HYDROBIONTS

nykh zavodov i ikh toksichnost' dlya gidrobion-
tov),
W77-09739 5C

HYDRODYNAMICS

The Effect of Coastal Hydrodynamics on the
Echinoderm Distribution in the Sublittoral of
Oxwich Bay, Bristol Channel,
W77-09944 2L

HYDROELECTRIC PLANTS

Hydro-Electric Development of the Tugela
River,
W77-10073 8C

HYDROGEN ION CONCENTRATION

Concerning the Influence of the Hydrogen Ion
Concentration and of the Bicarbonate Concen-
tration on the Structure of Biocenoses of
Mountain Brooks, (In German),
W77-09620 2I

Accommodation of *Daphnia pulex* to Altered pH
Conditions as Measured by Feeding Rate,
W77-09678 5C

Toxicity of 3-trifluoromethyl-4-nitrophenol
(TFM), 2',5-dichloro-4'-nitrosalicylanilide
(Bayer 73), and a 98:2 Mixture to Fingerlings of
Seven Fish Species and to Eggs and Fry of
Coho Salmon,
W77-09764 5C

Photodynamic Inactivation of Infectious
Agents,
W77-09883 5D

HYDROGEN PEROXIDE TREATMENT (WASTE WATER)

Hydrogen Peroxide Subdues Waste Water
Plant Problems,
W77-09858 5D

HYDROGEN SULFIDE

Toxicity of Hydrogen Sulfide to Various Life
History Stages of Bluegill (*Lepomis
macrochirus*),
W77-09668 5C

HYDROGEOLOGY

Groundwater Pollution Hazard Near Sanitary
Landfills on the Glaciated Plains, North Dakota
- A Study of the Langdon, North Dakota Sanitary
Landfill,
W77-09925 5B

Geohydrology of Muscatine Island, Muscatine
County, Iowa,
W77-10012 4B

HYDROLOGIC BUDGET

Estimating the Water and Salt Budgets of a
Stratified Estuary,
W77-09709 2L

HYDROLOGIC DATA

Water Resources Data for Ohio, Water Year
1975--Volume 1. Ohio River Basin.
W77-10000 7C

Water Resources Data for Ohio, Water Year
1975--Volume 2. St. Lawrence River Basin.
W77-10001 7C

Water Resources Data For Wyoming, Water
Year 1975,
W77-10002 7C

Annual Water-Resources Review White Sands
Missile Range, 1976 - A Basic-Data Report,
W77-10005 4B

Federal Plan for Acquisition of Water Data by
Federal Agencies, Fiscal Year 1977.
W77-10013 7C

HYDROLOGICAL EVENTS

Return Periods of Hydrological Events,
W77-09958 2B

HYDROLOGY

Return Periods of Hydrological Events,
W77-09958 2B

HYDROLYSIS

Chemically Assisted Biological Oxidation of
Wastes and Excess Sludge,
W77-09871 5D

ICE PARTICLES

Deduction of Ice Particle Types in the Vicinity
of the Melting Layer from Doppler Radar Mea-
surements,
W77-09720 2B

ICE-RAFTING

North Atlantic Ice-Rafting: A Major Change at
75,000 Years Before the Present,
W77-09706 2J

IDAHO

The Effects of Granitic Sand on the Distribu-
tion and Abundance of Salmonids in Idaho
Streams,
W77-09797 2I

IGLOO ABSORBER TESTS

Igloo Wave Absorber Tests for Port Washing-
ton Harbor, Wisconsin; Hydraulic Model In-
vestigation,
W77-09990 8B

ILLINOIS

Optimal Operation of Flood Control Systems,
(Final Report; V.II),
W77-09927 4A

Water Supply from Shelbyville and Carlyle
Lakes and Their Optimal Joint Operation,
W77-09943 4A

Flow Conditions at Pumping Stations, Cairo, Il-
linois; Hydraulic Model Investigation,
W77-10043 8B

IMPOUNDED WATERS

Mercury Accumulation by Largemouth Bass
(*Micropterus salmoides*) in Recently Im-
pounded Reservoirs,
W77-09667 5C

IMPOUNDMENTS

The Consequences of Impoundment on an Arc-
tic Char Lake System. An Analysis by Simula-
tion Modelling,
W77-09616 5B

Mercury Accumulation by Largemouth Bass
(*Micropterus salmoides*) in Recently Im-
pounded Reservoirs,
W77-09667 5C

INCINERATION

Jet-Flame Saves Sludge Disposal Cost with
Deodorizing Effect,
W77-09737 5E

Co-Burning of Sludge and Refuse with Waste
Heat Recovery,
W77-09857 5E

How Sludge Characteristics Affect Incinerator
Design,
W77-09869 5E

Options for Sludge--To Land, Sea or Fire,
W77-09918 5E

INCUBATION

Effect of Pretreatment on Loss of Nitrogen-15-
Labelled Fertilizer Nitrogen from Waterlogged
Soil During Incubation,
W77-09643 2G

INDIA

An Approach to Reduce Water Consumption in
Neighborhoods Through Reuse,
W77-09855 5D

The Handling of Nitrogenous Wastes in Rural
India,
W77-09900 5D

INDIAN OCEAN

Satellite-Derived Global Oceanic Rainfall Atlas
(1973 and 1974),
W77-09693 7C

INDIAN RESERVATIONS

Water Resources of the Umatilla Indian Reser-
vation, Oregon,
W77-10011 4A

INDICATORS

Steroids as Sewage Specific Indicators in New
York Bight Sediments,
W77-09901 5A

INDUSTRIAL WASTES

Treatment of Denim Textile Mill Wastewaters:
Neutralization and Color Removal,
W77-09724 5D

Relationship of Effluent Limitations to Future
Pulp Mill Closures,
W77-09727 5D

Characterization of Spent Bleaching Liquors.
Part 1, Spent Liquors from the Chlorine and
Alkali Extraction Stages in the Prebleaching of
Pine Kraft Pulp,
W77-09731 5A

Application of Reverse Osmosis and Ultrafil-
tration to the Purification of Pulp and Paper In-
dustry Effluents (Zastosowanie odwróconej os-
mozy i ultrafiltracji do oczyszczania sciekow z
przemysłu celulozowo-papierniczego),
W77-09733 5D

Studies and Comparisons of Determinations of
Phenols in Water: Application to the Examina-
tion of a Paper Mill Effluent (Etudes et com-
paraisons des determinations des phenols dans
les eaux: application a l'examen d'un rejet de
papier),
W77-09736 5A

Treating Wood Preserving Plant Wastewater by
Chemical and Biological Methods,
W77-09759 5D

Detoxification of Aqueous Waste Streams Con-
taining Cyanide,
W77-09812 5D

Method of Treating Waste Water Containing
Surfactant and Heavy Metals,
W77-09815 5D

Liquid Filtering Apparatus,
W77-09820 5D

Gravitational Separator,
W77-09821 5D

South Bend's Industrial Surveillance Waste
Water Monitoring Program,
W77-09919 5A

SUBJECT INDEX

IRRIGATION EFFICIENCY

- Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B
- INDUSTRIAL WATER**
A Unique Means of Obtaining Sea-Water, W77-09692 8E
- INFILTRATION**
New Sewer System Resists Infiltration, W77-09843 5D
Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D
- INFLOW**
Deep Water Renewal and Associated Processes in North Norway, W77-09947 2L
Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L
- INFORMATION RETRIEVAL**
Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A
- INHIBITORS**
Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B
- INLAND WATERWAYS**
Bay Springs Lake Water-Quality Study, W77-10055 5B
- INORGANIC COMPOUNDS**
Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C
- INSECTICIDES**
Influence of Cation Content on the Biological Activity of Fensulfothion in Plainfield Sand, W77-09639 2G
The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C
- INSTRUMENTATION**
Acoustical Wave Flowmeter, W77-09809 7B
Making Sure of Pipeline Performance, W77-10068 8A
- INTER-BASIN TRANSFERS**
Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B
- INTERCEPTION**
A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D
- INTERCEPTION LOSS**
A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D
- INTERSTICES**
The Nature of Changes in Bulk Density with Water Contents in Cracking Clay, W77-09937 2G
- ION EXCHANGE**
Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A
- IONIZATION**
Inactivation by Ionizing Radiation of *Salmonella* Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D
- IONS**
Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of Cd by Montmorillonite, W77-09658 5B
Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C
- IOWA**
Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C
Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B
- IRELAND**
Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter, W77-09971 2G
- IRISH SEA**
A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L
- IRON**
Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B
Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B
Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A
- IRON HYDROXIDE**
Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G
- IRRADIATION**
Pasteur v Curie, W77-09864 5D
Radiation Treatment of Sewage Sludge--Experience with an Operating Pilot Plant, W77-09876 5D
- Inactivation by Ionizing Radiation of *Salmonella* Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D
- Photodynamic Inactivation of Infectious Agents, W77-09883 5D
- IRRIGATED LANDS**
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations, W77-09974 2G
- IRRIGATION**
Temporally and Areally Distributed Rainfall, W77-09696 2B
Grove Irrigation System, W77-09800 3F
Self-Regulating Sprinkler, W77-09801 3F
Rotary Sprinkler Particularly for Use with Low-Energy Water Jets, W77-09802 3F
Underground Irrigation Porous Pipe, W77-09810 3F
Traveling Irrigation Sprinkler, W77-09811 3F
Remote Control for Large-Area Sprinkler Systems, W77-09814 3F
Spray Irrigation-Waste Water Treatment Facility. North Branch Fire District No. 1, West Dover, Vermont. W77-09828 5D
Selected Water-Level Records for Western Oklahoma, 1975-1976, W77-09998 7C
Scientific Bases of a System for Averting Unfavorable Consequences of Steppe Soil Irrigation, (In Russian), W77-10021 2G
- IRRIGATION CANALS**
The Functional and Aesthetic Uses of Two Cache Valley, Utah, Canals, W77-09796 6B
1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A
- IRRIGATION EFFECTS**
Underground Irrigation Porous Pipe, W77-09810 3F
- IRRIGATION EFFICIENCY**
Grove Irrigation System, W77-09800 3F
Rotary Sprinkler Particularly for Use with Low-Energy Water Jets, W77-09802 3F
Traveling Irrigation Sprinkler, W77-09811 3F
Irrigation Requirements of Mature Peach Trees Under Microjets (Besproeiingsbehoefes van volwasse perskebome onder mikrospruite), W77-10079 3F

SUBJECT INDEX

IRRIGATION ENGINEERING

IRRIGATION ENGINEERING

Effect of Leaching Fraction on River Salinity,
W77-09697 5G

IRRIGATION PRACTICES

Traveling Irrigation Sprinkler,
W77-09811 3F

IRRIGATION SYSTEMS

Through the Andes.
W77-09687 8A

Grove Irrigation System,
W77-09800 3F

Remote Control for Large-Area Sprinkler
Systems,
W77-09814 3F

ISOPHORONE

Investigation of Selected Potential Environ-
mental Contaminants: Ketonic Solvents,
W77-09770 5B

ISOTOPE STUDIES

Carbon Isotopic Study of the Fate of Landfill
Leachate in Groundwater,
W77-09917 5B

ISRAEL

Heavy Metal Concentrations in Water, Sedi-
ments, and Fish from Mediterranean Coastal
Area, Israel,
W77-09742 5A

ISRAEL (FISH PRODUCTION)

Agricultural Wastes in Fish Farming. A Com-
mercial Application of the Culture of Single-
Celled Organisms for Protein Production,
W77-10050 5E

ITALY

Lead and Freshwater Fishes: Part 2--Ionic
Lead Accumulation,
W77-09779 5C

JAPAN (EASTERN HOKKAIDO)

Studies on the Bottom Fauna of Four Lakes in
Eastern Hokkaido (Lakes Kusshyaro-Ko,
Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In
Japanese),
W77-10028 5C

JETS

Buoyant Surface Jets Discharged into a Strong
Crossflow,
W77-09926 5B

JUBAIL HARBOR (SAUDI ARABIA)

Stability of Rubble-Mound Breakwater Jubail
Harbor, Saudi Arabia; Hydraulic Model In-
vestigation,
W77-09984 8B

JUNIPER TREES

Vegetation Manipulation--A Case Study of the
Pinyon-Juniper Type,
W77-09959 4C

JUVENILE FISH

Effects of Exposure to Heavy Metals on
Selected Fresh Water Fish. Toxicity of Copper,
Cadmium, Chromium and Lead to Eggs and
Fry of Seven Fish Species,
W77-09784 5C

KANSAS

Geochemical Controls on Trace Element Con-
centrations in Natural Waters of a Proposed
Coal Ash Landfill Site,
W77-09928 5B

Evaluation of an Evapotranspiration Model for
Corn,
W77-09941 2D

KENTUCKY

Ground-Water Resources of the Lexington,
Kentucky, Area,
W77-09996 4B

KENTUCKY BLUEGRASS

Long-Term Evaluation of Slow-Release
Nitrogen Sources of Turfgrass,
W77-09978 3C

KENYA

The Origin of Horizontal Laminae in
Ephemeral Stream Channel-Fill,
W77-09950 2J

KETONIC SOLVENTS

Investigation of Selected Potential Environ-
mental Contaminants: Ketonic Solvents,
W77-09770 5B

KIDNEY FUNCTION

Renal Excretion in Channel Catfish Following
Injection of Quinaldine Sulphate or 3-tri-
fluoromethyl-4-nitrophenol,
W77-09662 5C

KINETIC MODELS (SOILS)

Comparison of Five Kinetic Models for
Orthophosphate Reactions in Mineral Soils,
W77-09968 2G

KINETICS

Study of the Decomposition of Organic Matter
by the Respirometric Dilution Method
(Untersuchungen ueber das Abbaueverhalten or-
ganischer Stoffe mit Hilfe der
respirometrischen Verduennungs-methode),
W77-09888 5D

Comparison of Five Kinetic Models for
Orthophosphate Reactions in Mineral Soils,
W77-09968 2G

Relation Between the Kinetics of Nitrogen
Transformation and Biomass Distribution in a
Soil Column During Continuous Leaching,
W77-09973 2G

The Slow Reaction which Continues After
Phosphate Adsorption: Kinetics and Equilibri-
um in Some Tropical Soils,
W77-09980 2G

Calcium Carbonate Precipitation Kinetics, Part
I, Pure System Kinetics,
W77-10087 5F

KOOTENAI RIVER (MONT)

Center Sluice Investigation, Libby Dam
Kootenai River, Montana; Hydraulic Model In-
vestigation,
W77-10044 8B

Sluice Pressures, Gate Vibrations and Stilling
Basin Wall Pressures Libby Dam, Kootenai
River, Montana,
W77-10045 8B

KRAFT MILLS

Closed-Cycle Mill Eliminates Pollution While
Also Saving Money,
W77-09740 3E

LABORATORY EQUIPMENT

Continuous-Flow Apparatus for Use in Petrole-
um Bioassay,
W77-09681 5A

Research and Development of an Elec-
trochemical Biocide, Final Report,
W77-09771 5D

LABORATORY TESTS

Continuous-Flow Apparatus for Use in Petrole-
um Bioassay,
W77-09681 5A

Effects of Aroclor (R) 1254 on Brook Trout,
Salvelinus Fontinalis,
W77-09783 5C

Evaporation from a Warm, Wavy Surface: A
Laboratory Study,
W77-09954 2D

The Effect of Copper on Competition Between
Marine Algae,
W77-10051 5C

LAGOONS

Partial Analysis of the Microplankton in the
Lagoon of Pueblo Viejo, State of Vera Cruz,
Mexico, (In Spanish),
W77-10066 2L

LAKE

Classifying and Monitoring Water Quality by
Use of Satellite Imagery,
W77-09634 5A

LAKE BAIKAL (USSR)

Dilution Characteristics of Effluents in Deep
Water Reservoirs Determined with a Radioac-
tive Indicator (On the Example of Lake
Baikal), (In Russian),
W77-09735 5B

LAKE DARDANELLE (ARK)

Lake Dardanelle, Arkansas River; Hydraulic
Model Investigation,
W77-09988 8B

LAKE EDEBERG (GERMANY)

Analysis of the Population Dynamics of Oscil-
latoria Redekci Van Goor in Lake Edeberg,
W77-09629 5C

LAKE ERIE

Seasonal Variations in Great Lakes Design
Wave Heights: Lake Erie,
W77-09986 8B

Lake Erie International Jetport Model Feasi-
bility Investigation; Report 17-4, Numerical
Model Feasibility Study,
W77-10048 8B

LAKE HARTWELL (SC)

Mercury Accumulation by Largemouth Bass
(Micropterus salmoides) in Recently Im-
pounded Reservoirs,
W77-09667 5C

LAKE JOCASSEE (SC)

Mercury Accumulation by Largemouth Bass
(Micropterus salmoides) in Recently Im-
pounded Reservoirs,
W77-09667 5C

LAKE KARIBA (AFRICA)

The Physico-Chemical Limnology of the
Mwenda River Mouth, Lake Kariba,
W77-09614 5C

LAKE KEOWEE (SC)

Mercury Accumulation by Largemouth Bass
(Micropterus salmoides) in Recently Im-
pounded Reservoirs,
W77-09667 5C

SUBJECT INDEX

LETHAL LIMIT

LAKE MAGGIORE (ITALY)

- Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C

LAKE MICHIGAN

- A Food Web Model for Lake Michigan: Part I--Justification and Development of the Model, W77-09631 5C
- Environmental Status of the Lake Michigan Region: Vol. 4. Phytoplankton of Lake Michigan, W77-10056 5C

LAKE MULEHE (UGANDA)

- Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C

LAKE ONTARIO

- Algal Nutrient Availability and Limitation in Lake Ontario During IFGYL. Part 1, Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters, W77-10052 5C
- An Investigation of the Nearshore Region of Lake Ontario IFYGL, W77-10053 5C

LAKE POWELL (UTAH)

- Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J

LAKE REHABILITATION

- A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

LAKE RESTORATION

- Studies on the Reclamation of Stone Lake, Michigan, W77-09605 5G
- Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

LAKE SAMMAMISH (WASH)

- Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

LAKE SEDIMENTS

- Studies on the Reclamation of Stone Lake, Michigan, W77-09605 5G
- Macrophyte-Sediment Relationships in Chautauqua Lake, W77-09612 5C
- An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C
- Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J
- A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

LAKE SIBAYA

- Lake Sibaya - A Land-Locked Estuary, W77-10099 2H

LAKE SUPERIOR

- Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C

LAKES

- A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G
- Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G
- The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba, W77-09614 5C
- Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B
- The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H
- Lake Sibaya - A Land-Locked Estuary, W77-10099 2H

LAMINATION

- The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill, W77-09950 2J

LAMPRICIDES

- Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C
- The Freshwater Mussel (Anodonta SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

LAND APPLICATION

- Spray Irrigation-Waste Water Treatment Facility, North Branch Fire District No. 1, West Dover, Vermont, W77-09828 5D

LAND CLEARING

- Vegetation Manipulation--A Case Study of the Pinyon-Juniper Type, W77-09959 4C

LAND RECLAMATION

- Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian), W77-09630 3C

LANDFILL

- Options for Sludge--To Land, Sea or Fire, W77-09918 5E
- Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B

LANDFILLS

- Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater, W77-09917 5B
- Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota

- A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B

LARVAL GROWTH STAGE

- The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of *Serpula Vermicularis* L. (Annelida: Polychaeta), W77-09684 5C

LEACHATE

- Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater, W77-09917 5B

LEACHING

- Effect of Leaching Fraction on River Salinity, W77-09697 5G
- Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils, W77-09666 5B
- Relation Between the Kinetics of Nitrogen Transformation and Biomass Distribution in a Soil Column During Continuous Leaching, W77-09973 2G

LEAD

- Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

- Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

- Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

- Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C

- Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

LEAST SQUARES METHOD

- A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties, W77-10008 2F

LEAVES

- Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

LEE COUNTY (FLA)

- Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year, W77-10014 2F

LEGISLATION

- Cross Canada Report, W77-09923 5G

LETHAL LIMIT

- Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

SUBJECT INDEX

LETHAL LIMIT

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

LEXINGTON AREA (KY)

Ground-Water Resources of the Lexington, Kentucky, Area, W77-09996 4B

LIBBY DAM (MONT)

Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

LIFE HISTORY STUDIES

Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

LIFT STATIONS (SEWAGE)

Analysis of Economic Sewage Lift Station Design, W77-09906 8C

LIGHT

Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D

LIME

Some Effects of Lime Addition on High Solids, Completely Mixed, Activated Sludge Waste Water Treatment, W77-09601 5D

Chemical Treatment of Sewage, W77-09892 5D

LIMESTONES

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

LIMNOLOGY

The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba, W77-09614 5C

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase 1, W77-10061 5C

LININGS

Corrosion Avoidance in Water and Sewage Pipelines, W77-09832 8F

PVC Lining--The Answer to Corrosive Attack by H2S in Concrete Sewers and Structures. W77-09835 8G

Watertight Case for Pond Liners. W77-09891 5G

LIVESTOCK WASTE MANAGEMENT

Application of the Rotating Flighted Cylinder to Livestock Waste Management, W77-09795 5D

LOADS (FORCES)

Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanälen und -leitungen), W77-09833 8G

LOCKS

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

LOG RAFTING

Water Transport of Wood (In Canada): The Current Situation, W77-09755 5C

LONG BEACH HARBOR (CAL)

Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B

LONG BEACH HARBOR (CALIF)

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

LONG ISLAND (NY)

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

LONG ISLAND SOUND

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

LONG POND (ST. JOHNS)

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

LONG-TERM PLANNING

Arid Lands of Sub-Saharan Africa. W77-09934 6E

LONGSHORE WAVES

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

LOS ANGELES HARBOR (CAL)

Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

LOUGH NEAGH (NORTHERN IRELAND)

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

LOUISIANA

Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B

LOW FLOW

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B

LOWER POTOMAC RIVER ESTUARY (VA)

A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L

LOWER ST. REGIS LAKE (NY)

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

LUGWORM

The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), W77-09675 5C

LUMBERING

Logging Roads and Protection of Water Quality, W77-09725 5G

Water Transport of Wood (In Canada): The Current Situation, W77-09755 5C

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality. W77-09756 5G

Effects of Log Handling and Storage on Water Quality, W77-09760 5C

LUMBERING WASTES

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality. W77-09756 5G

MACKENZIE RIVER WATERSHED (CANADA)

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

MACROINVERTEBRATES

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

MAGNESIUM

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

MAGNETIC SEPARATION

Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D

MAINE

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

MALATHION

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

SUBJECT INDEX

MESITYL OXIDE

MALLARD DUCKS

- Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

MANAGEMENT

- Weather Modification Effects and Management (A Bibliography with Abstracts), W77-09694 2B

- Construction Management for Waste Water-treatment Plants, W77-09920 5D

MANGANESE

- Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F

- Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K

- Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

- Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A

MAPPING

- The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing, W77-10007 2H

MAPS

- Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C

MARINE ALGAE

- Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C

- Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

- The Effect of Copper on Competition Between Marine Algae, W77-10051 5C

MARINE BENTHOS

- Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C

MARINE MICROORGANISMS

- Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

MARINE SEDIMENT BACTERIA

- Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

MARSHES

- Wastewater Treatment by Natural and Artificial Marshes, W77-09606 5D

MASS SPECTROMETRY

- Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A

- Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

MASSACHUSETTS

- Paper Mill Wastewater Treatment by Microstraining, W77-09758 5D

- Determining Photosynthetic Productivity in Streams, W77-10080 5C

MATHEMATIC MODELS

- Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

MATHEMATICAL MODELS

- Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

- Mathematical Description of Some Physical Snow Cover Characteristics, W77-09717 2C

- A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei oosenbushitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosokumoderu no kaihatsu ni kansuru kenkyu), W77-09911 5B

- Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B

- Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model, W77-09981 5B

- Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

- Method of Analyzing Some Experimental Data on Zooplankton, (In Russian), W77-10038 2I

- Bay Springs Lake Water-Quality Study, W77-10055 5B

- Small Catchment Flood Modelling, W77-10083 2E

MAYFLIES

- Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), W77-09620 2I

MEASUREMENT

- An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C

- A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A

- Zeta Potential Measurement, W77-09908 5A

MEDITERRANEAN CLIMATE

- The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

MEDITERRANEAN SEA (ISRAEL)

- Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

MELOSIRA GRANULATA

- Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C

MEMBRANE PROCESSES

- Regular Copolyamides as Desalination Membranes, W77-09806 3A

- Semipermeable Membranes and the Method for the Preparation Thereof, W77-09817 3A

- Application of Membrane Processes, W77-09929 3A

MEMBRANES

- Regular Copolyamides as Desalination Membranes, W77-09806 3A

- Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D

MERCURY

- The Role of Humic Acids in the Uptake and Release of Mercury by Freshwater Sediments, W77-09615 5B

- Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

- Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C

- The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of *Serpula vermicularis* L. (Annelida: Polychaeta), W77-09684 5C

- Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

- Standardization of Methylmercury Analysis, W77-09775 5A

- Mercury Detection Simplified, W77-10084 5A

MERCURY EXCHANGE

- Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

MERCURY IONS

- Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

MESITYL OXIDE

- Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

SUBJECT INDEX

MESITYL OXIDE

MESOTROPHY

Characteristics of the Zooplankton of the Lower Reaches of the Irgiz and Turgay Rivers, (In Russian), W77-09940 5C

METABOLISM

ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

METAL COMPLEXES

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

METALS

Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C

Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

Standardization of Methylmercury Analysis, W77-09775 5A

Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A

Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B

METHANE

Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C

METHANE OXIDATION

Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C

METHODOLOGY

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A

Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A

The Effects of Salinity, Temperature, and Mercury on Mortality of the Trecophore Larvae of *Serpula Vermicularis* L. (Annelida: Polychaeta), W77-09684 5C

Determination of Arsenic Species in Natural Waters, W77-09747 5A

The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975, W77-09769 5A

Standardization of Methylmercury Analysis, W77-09775 5A

Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation, W77-09985 6G

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

Bottom Withdrawal can Enhance Lake Water Quality, W77-10049 5G

METHYL ETHYL KETONE

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

METHYL ISOBUTYL KETONE

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

METHYL PARATHION

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C

METHYLMERCURY ANALYSIS

Standardization of Methylmercury Analysis, W77-09775 5A

MICAS

Ice Nucleation by Micas, W77-09956 2B

MICHIGAN

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase I, W77-10061 5C

MICROBIAL DEGRADATION

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C

MICROBIAL FORMATION (SOILS)

Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G

MICROBIAL INORGANIC POLYPHOSPHATES

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

MICROBIOLOGY

Wastewater Microbiology, W77-09893 5D

MICROFLOTATION (WASTE WATER)

Microflotation in Effluent Purification (Mikroflotation in der Abwasseraufbereitung), W77-09899 5D

MICROHAEMATOCRIT

The Effect of Tricain Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

MICRONUTRIENTS

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

MICROORGANISMS

Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

Wastewater Microbiology, W77-09893 5D

MICROTRAINING (TREATMENT)

Paper Mill Wastewater Treatment by Micro-training, W77-09758 5D

MID-ATLANTIC BIGHT

Identification and Analysis of Mid-Atlantic Onshore OCS Impacts, W77-10027 5C

MILAN ARMY AMMUNITION PLANT

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

MILL CLOSURES

Relationship of Effluent Limitations to Future Pulp Mill Closures, W77-09727 5D

MINE WASTES

Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C

MINERALS DEPOSITION

The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill, W77-09950 2J

MINNESOTA

Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C

SUBJECT INDEX

MONTANA

MIREX

- The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), W77-09675 5C

MISSISSIPPI

- Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B

- The Cockfield Aquifer in Mississippi, W77-09991 7C

- Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B

MISSISSIPPI RIVER

- Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

- Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L

MISSISSIPPI RIVER BASIN

- Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

MIXED HYDROCARBON SUBSTRATE

- Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

MIXING

- Mixer Cuts Solids Up and Time Down for Waste Treatment, W77-09885 5D

- Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

- Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L

- The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L

- Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

MODE OF ACTION

- Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species, W77-09607 5C

MODEL STUDIES

- The Consequences of Impoundment on an Arctic Char Lake System. An Analysis by Simulation Modelling, W77-09616 5B

- A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model, W77-09631 5C

- An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, W77-09637 2F

- Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B

- A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L

- A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

- A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G

- A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L

- Movement of Snow Avalanches, W77-09716 2C

- Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L

- A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei osenbushitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosokumoderu no kaihatsu ni kansuru kenkyu), W77-09911 5B

- Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

- The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

- The Fate of Pollutants in Subsurface Environments, W77-09915 5B

- Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D

- Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G

- Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

- Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B

- Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve Flood-Frequency Estimates on Small Tennessee Streams, W77-10004 2A

- A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties, W77-10008 2F

- Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

- Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

MOISTURE CONTENT

- Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D

- An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch), W77-09613 2G

- Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

- Mathematical Description of Some Physical Snow Cover Characteristics, W77-09717 2C

- The Nature of Changes in Bulk Density with Water Contents in Cracking Clay, W77-09937 2G

- An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G

MOLYBDENUM

- Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K

- The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A

MONITORING

- Classifying and Monitoring Water Quality by Use of Satellite Imagery, W77-09634 5A

- Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

- Water System Virus Detection, W77-09636 5A

- Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

- Waste Water Biochemical Purification Control-By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution, W77-09845 5D

- South Bend's Industrial Surveillance Waste Water Monitoring Program, W77-09919 5A

- The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

MONTANA

- Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B

- Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

SUBJECT INDEX

MONTMORILLONITE

MONTMORILLONITE

Adsorption of Dodecylbenzene Sulfonate on NA(+)-Montmorillonite: Effect of Salt Impurities, W77-09651 2G

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of CD by Montmorillonite, W77-09658 5B

MORGAN LAKE (NM)

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J

MORTALITY

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of *Serpula vermicularis* L. (Annelida: Polychaeta), W77-09684 5C

Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

MUDMINNOWS

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

MULTIELEMENT ANALYSIS

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

MULTIPLE-PURPOSE PROJECTS

The Functional and Aesthetic Uses of Two Cache Valley, Utah, Canals, W77-09796 6B

Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation, W77-09943 4A

MULTIPLE-PURPOSE RESERVOIRS

Optimal Operation of Flood Control Systems, (Final Report; V.II), W77-09927 4A

MUNICIPAL WASTES

Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D

Land Application of Municipal Sludge, W77-09882 5E

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

MUNITIONS

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

MUSCATINE COUNTY (IOWA)

Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

MUSKEGON (MICH)

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase 1, W77-10061 5C

MUSSELS

ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

MYRIOPHYLLUM SPICATUM WATER

MILFOIL

Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

MYTILUS EDULIS

ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, W77-09671 5C

NANNOPLANKTON

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

NATAL (SOUTH AFRICA)

Wisselwerking tussen land en see, of, die ekologie van die kuswaters van Natal (The Inter-action between Land and Sea, or, the Ecology of the Coastal Waters of Natal), W77-10072 2L

NATIONAL WATER DATA NETWORK

Federal Plan for Acquisition of Water Data by Federal Agencies, Fiscal Year 1977, W77-10013 7C

NAVIGABLE RIVERS

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, W77-09988 8B

NAVIGATION

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, W77-09988 8B

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

NAVIGATION CHANNELS

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation, W77-09988 8B

Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B

NEMATODES

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

NETWORK DESIGN

Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B

NETWORKS

Federal Plan for Acquisition of Water Data by Federal Agencies, Fiscal Year 1977, W77-10013 7C

NEUSE ESTUARY (NC)

A Dynamic Water Quality Model for the Neuse Estuary, N.C., W77-10037 5B

NEUTRALIZATION

Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

NEUTRON METERS

Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

NEVADA

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J

NEW MEXICO

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

NEW RIVER (VA)

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

NEW YORK

Macrophyte-Sediment Relationships in Chaugauqua Lake, W77-09612 5C

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

SUBJECT INDEX

NORTH CAROLINA

- Restoration of Lower St. Regis Lake (Franklin County, New York),
W77-10054 5C
- NEW YORK BIGHT**
Steroids as Sewage Specific Indicators in New York Bight Sediments,
W77-09901 5A
- NICKEL**
Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel,
W77-09742 5A
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine,
W77-09766 5B
- NIRMALI SEED (TREATMENT)**
Nirmali Seed—A Naturally Occurring Coagulant,
W77-09861 5D
- NITRATE-NITROGEN CONCENTRATIONS (SOILS)**
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations,
W77-09974 2G
- NITRATE REDUCTION (SOILS)**
Comments on Nitrate Reduction in Unsaturated Soil,
W77-09650 2G
- NITRATES**
Comments on Nitrate Reduction in Unsaturated Soil,
W77-09650 2G
Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil,
W77-09653 5B
Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh,
W77-09722 5B
Nitrate and Phosphate Content of Ground and Surface Waters of the White River Drainage, Northwest Nebraska,
W77-09743 5B
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford,
W77-09761 5C
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations,
W77-09974 2G
- NITRIFICATION**
Nitrification in a Chlorinated Activated Sludge Culture,
W77-09851 5D
Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table,
W77-09907 5B
Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils,
W77-09966 5B
- NITRILOTRIACETIC ACID**
Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester,
W77-09751 5A
- NITRITE DECOMPOSITION (SOILS)**
Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions,
W77-09645 2G
- NITRITES**
Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions,
W77-09645 2G
Comments on Nitrate Reduction in Unsaturated Soil,
W77-09650 2G
- NITROGEN**
Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada,
W77-09617 5C
Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KCl,
W77-09641 3F
Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers,
W77-09642 3F
Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation,
W77-09643 2G
Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat,
W77-09655 3F
Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh,
W77-09722 5B
Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine,
W77-09793 5C
Nitrogen Control: Design Considerations for Supported Growth Systems,
W77-09848 5D
Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal,
W77-09873 5D
Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers,
W77-09904 5A
Ammonia Volatilization from Surface Applications of Ammonium Compounds on Calcareous Soils: V. Soil Water Content and Method of Nitrogen Application,
W77-09960 2G
Nitrogen, Phosphorus, and Potassium Utilization in the Plant-Soil System: An Analytical Model,
W77-09964 2I
Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils,
W77-09966 5B
- Relation Between the Kinetics of Nitrogen Transformation and Biomass Distribution in a Soil Column During Continuous Leaching,
W77-09973 2G
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations,
W77-09974 2G
Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass,
W77-09978 3C
- NITROGEN-15 LOSS (SOIL SAMPLES)**
Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation,
W77-09643 2G
- NITROGEN COMPOUNDS**
Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents,
W77-09669 5C
The Handling of Nitrogenous Wastes in Rural India,
W77-09900 5D
Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table,
W77-09907 5B
- NITROGEN FIXATION**
Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions,
W77-09676 5B
- NITROGEN SUPERSATURATION**
Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish,
W77-09792 5C
- NITROUS OXIDE**
Temperature Effects on the Denitrification Products by Two Aquatic *Pseudomonas* Species,
W77-09607 5C
- NON-UNIFORM FLOW**
Critical and Brink Depths in Elliptical Sewers,
W77-09841 8B
- NONPOINT POLLUTION SOURCES**
Loading Functions for Assessment of Water Pollution from Nonpoint Sources,
W77-09726 5B
- NORTH ATLANTIC OCEAN**
North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present,
W77-09706 2J
- NORTH CAROLINA**
Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil,
W77-10035 2L
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina,
W77-10036 2L
A Dynamic Water Quality Model for the Neuse Estuary, N.C.,
W77-10037 5B

SUBJECT INDEX

NORTH DAKOTA

NORTH DAKOTA

Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B

NORTH FORK LAKE DAM (TEX)

North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B

NORTHERN IRELAND

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

NORWAY

Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway, W77-09699 2J

Deep Water Renewal and Associated Processes in North Norway, W77-09947 2L

NOTHOLCA GRANDIS

Method of Analyzing Some Experimental Data on Zooplankton, (In Russian), W77-10038 2I

NUCLEAR POWERPLANTS

Simulation Factors Involved in Ocean Thermal Power Plants, W77-10034 5B

NUCLEATION

Ice Nucleation by Micas, W77-09956 2B

NUMERICAL ANALYSIS

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B

Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

NUTRIENT AVAILABILITY

Algal Nutrient Availability and Limitation in Lake Ontario During IFGYL. Part 1, Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters, W77-10052 5C

NUTRIENT REMOVAL

Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

NUTRIENTS

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

Controlling the Access of Nutrients from Point and Diffused Sources with Special Reference to the Pretoria/Witwatersrand/Vereeniging Region, W77-10082 5G

OBSERVATION WELLS

Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year, W77-10014 2F

OCEAN DISPOSAL

Options for Sludge--To Land, Sea or Fire, W77-09918 5E

OCEAN THERMAL POWERPLANTS

Simulation Factors Involved in Ocean Thermal Power Plants, W77-10034 5B

OCEANIC RAINFALL ATLAS

Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C

OCEANOGRAPHIC WATER SAMPLERS

Oceanographic Water Sampler, W77-09799 7B

OCEANS

North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present, W77-09706 2J

A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L

ODOR

Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect, W77-09737 5E

OHIO

Water Resources Data for Ohio, Water Year 1975--Volume 1. Ohio River Basin, W77-10000 7C

Water Resources Data for Ohio, Water Year 1975--Volume 2. St. Lawrence River Basin, W77-10001 7C

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

OIL

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

OIL AND GREASE

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

OIL BOOMS

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

OIL INDUSTRY

Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C

OIL POLLUTION

Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

Method for Detecting Oil in Water, W77-09813 5A

Oil Spill Identification System, W77-10024 5A

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

OIL RECOVERY

Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C

OIL SPILL REMOVAL EQUIPMENT

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

OIL SPILLS

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

Oil Spill Identification System, W77-10024 5A

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

OIL WASTES

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

Method for Detecting Oil in Water, W77-09813 5A

SUBJECT INDEX

OVERFLOW

OKLAHOMA

Water Reuse in a Paper Reprocessing Plant,
W77-09757 5D

Selected Water-Level Records for Western
Oklahoma, 1975-1976,
W77-09998 7C

Ground-Water Levels in Observation Wells in
Oklahoma, 1975,
W77-09999 7C

OLD RIVER CONTROL STRUCTURE (LA)

Old River Existing Low-Sill Control Structure,
Louisiana; Hydraulic Model Investigation,
W77-10018 8B

OLIFANTS RIVER

Further Important Features of the Fish Fauna
of the Clanwilliam Olifants River System,
Southwestern Cape,
W77-10090 2E

OLIGOCHAETES

Oligochaeta of the Deniester River Mouth Re-
gion, (In Russian),
W77-10065 2L

OLIGOTROPHIC

Mercury Accumulation by Largemouth Bass
(*Micropterus salmoides*) in Recently Im-
pounded Reservoirs,
W77-09667 5C

OPEN CHANNEL FLOW

Old River Existing Low-Sill Control Structure,
Louisiana; Hydraulic Model Investigation,
W77-10018 8B

OPEN LAKE DISPOSAL

A Report on Studies of the Effects of Dredging
and Disposal in the Great Lakes with Emphasis
on Canadian Waters,
W77-09794 5C

OPERATION AND MAINTENANCE

Application of Membrane Processes,
W77-09929 3A

OPERATIONS

Design and Operation of Rain Spillways and
Rain Overflow Catchment (Entwurf und
Betrieb von Regenüberläufen (Ru) und Regen-
überlaufbecken (RUB),
W77-09822 8B

OPERATIONS RESEARCH

Water Supply from Shelbyville and Carlyle
Lakes and Their Optimal Joint Operation,
W77-09943 4A

OPTIMAL OPERATION (RESERVOIRS)

Optimal Operation of Flood Control Systems,
(Final Report; V.II),
W77-09927 4A

ORANGE-FISH TUNNEL (SOUTH AFRICA)

The Day They Almost Abandoned the Orange-
Fish Tunnel,
W77-10077 8A

ORANGE FREE STATE

Waterfowl (Anatidae) on Irrigation Lakes in the
Orange Free State,
W77-10097 2H

OREGON

Seasonal Variation in Temperature, Salinity,
and Density Over the Continental Shelf Off
Oregon,
W77-09703 2L

Water Quality: Western Fish Toxicology Sta-
tion and Western Oregon Rivers,
W77-09777 5A

Water Resources of the Umatilla Indian Reser-
vation, Oregon,
W77-10011 4A

1976 Water-Quality Data in Bear Creek Basin,
Medford, Oregon,
W77-10015 5A

The Causes of Erosion to Siletz Spit, Oregon,
W77-10039 2L

ORGANIC CARBON

Experiences with the Organic Carbon Analyzer
(TOC) by Merz for Routine Monitoring at the
BASF Purification Plant (Erfahrungen mit dem
TOC-Schnellbestimmer nach Merz in der Rou-
tineüberwachung der BASF),
W77-09894 5A

Parameters which Influence the Organic Car-
bon Determination in Water,
W77-10092 5A

ORGANIC COMPOUNDS

Gas Stripping, Sorption, and Thermal Desorp-
tion Procedures for Preconcentrating Volatile
Polar Water-Soluble Organics from Water Sam-
ples for Analysis by Gas Chromatography,
W77-09746 5A

Environmental Applications of Advanced In-
strumental Analyses: Assistance Projects, FY
75,
W77-09782 5A

ORGANIC MATTER

An Investigation of the Role of Organic Materi-
als in Freshwater Systems,
W77-09618 5C

Continuous On-Line Monitoring of Total Or-
ganic Carbon,
W77-09635 5A

Chlorination Reactions of Fulvic Acids in
Natural Waters,
W77-09741 5F

Growth Responses of Chicks Fed Microbial
Protein Produced from Organic Wastes,
W77-09785 5C

Organic Matter Removal by Powdered Ac-
tivated Carbon Added to Activated Sludge,
W77-09850 5D

Study of the Decomposition of Organic Matter
by the Respirometric Dilution Method
(Untersuchungen ueber das Abbauverhalten or-
ganischer Stoffe mit Hilfe der
respirometrischen Verdünnungsmethode),
W77-09888 5D

Effect of Sorbed Organics on the Efficiency of
Ammonia Removal by Chloramine-Carbon Sur-
face Reactions,
W77-09902 5D

Simulation of Plant Growth by Humic Sub-
stances,
W77-09963 2I

Estimation of Components of Soil Cation
Exchange Capacity from Measurements of
Specific Surface and Organic Matter,
W77-09971 2G

ORGANIC WASTES

Computer Interpretation of Pollutant Mass
Spectra,
W77-09776 5A

Growth Responses of Chicks Fed Microbial
Protein Produced from Organic Wastes,
W77-09785 5C

ORGANOCHLORINE PESTICIDES

Organochlorine Pesticides and PCBs Distribu-
tion in Tissues of Purple Heron and Spoon
Duck from the Biological Reserve of Donana
(Spain),
W77-09677 5A

ORGANOLEPTIC PROPERTIES

Growth Responses of Chicks Fed Microbial
Protein Produced from Organic Wastes,
W77-09785 5C

ORGANOPHOSPHOROUS PESTICIDES

The Toxicity of Malathion and Its Hydrolysis
Products to the Eastern Mudminnow, *Umbra
pyma* (DeKay),
W77-09670 5C

ORTHOPHOSPHATES

Comparison of Five Kinetic Models for
Orthophosphate Reactions in Mineral Soils,
W77-09968 2G

OSCILLATORIA REDEKEI

Analysis of the Population Dynamics of Oscil-
latoria Redekei Van Goor in Lake Edeberg,
W77-09629 5C

OTTAWA RIVER

Competition for Mercury Between River Sedi-
ment and Bacteria,
W77-09661 5B

OUTER CONTINENTAL SHELF

The Georgia Coastal Environment. A Compila-
tion of Resource Materials Covering the
Coastal Plain, Estuaries and Offshore Waters.
W77-10025 2L

Identification and Analysis of Mid-Atlantic
Onshore OCS Impacts.
W77-10027 5C

Oil and Gas Seeps in Alaska. Alaska Peninsula,
Western Gulf of Alaska,
W77-10033 5B

OUTFALL SEWERS

Go Ahead for Long Sea Outfall.
W77-09836 5D

OUTFALLS

Impact on Marine Benthos of Waste Water
Discharge,
W77-09846 5C

Advance Sewer Planning for Rio de Janeiro
Coastline,
W77-09890 5D

Effluent Treatment Versus Disposal Through
Long Sea Outfalls,
W77-09895 5E

OUTLET WORKS

North Fork Lake Spillway San Gabriel River,
Texas; Hydraulic Model Investigation,
W77-10017 8B

OVERFLOW

Treatment of Combined Sewer Overflows by
High Gradient Magnetic Separation,
W77-09825 5D

SUBJECT INDEX

OVERFLOW

Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D

OVERFLOWS

Urban Runoff Pollution Control--Technology Overview, W77-09823 5D

OXIDATION

Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C

Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D

Oxidation Ditch Gives Low-Cost Secondary Treatment, W77-09866 5D

Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

OXIDATION LAGOONS

Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D

Oxidation Ditch Gives Low-Cost Secondary Treatment, W77-09866 5D

The Handling of Nitrogenous Wastes in Rural India, W77-09900 5D

BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase I, W77-10061 5C

OXIDATION REDUCTION POTENTIAL

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

OXWICH BAY (WALES)

The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel, W77-09944 2L

OXYGEN

Waste Purification Process, W77-09865 5D

OXYGEN DEMAND

Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A

OXYGEN SUPERSATURATION

Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C

OXYGEN TENSION

Influence of Certain Water Conditions, Especially Dissolved Gasses, on Trout, W77-09790 5C

OXYGEN TRANSFER

Thurrock Test-Bed for ICI Deep Shaft, W77-09859 5D

OYSTERS

Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish), W77-10066 2L

Dehydration of Marine Zoological Material - Volatility of Metabolised Selenium at 105-120C, W77-10095 5A

PACIFIC COAST REGION

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

PACIFIC OCEAN

Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C

Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

PACKED BEDS

Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D

PALAEON

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C

PALAEONETES

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C

PARASITIC INFECTION

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

PARASITISM

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

PARSONS LAKE (TEXAS)

Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C

PARTICLE SIZE

Macrophyte-Sediment Relationships in Chaustagua Lake, W77-09612 5C

PASTEURIZATION

Pasteur v Curie, W77-09864 5D

PATENTS

Matting for the Prevention of Hydraulic Erosion, W77-09798 4D

Oceanographic Water Sampler, W77-09799 7B

Grove Irrigation System, W77-09800 3F

Self-Regulating Sprinkler, W77-09801 3F

Rotary Sprinkler Particularly for Use with Low-Energy Water Jets, W77-09802 3F

Motor Powered by Wave Action, W77-09803 8C

Distillation Apparatus and Method, W77-09804 3A

Method and Apparatus for Aerobic Sewage Treatment, W77-09805 5D

Regular Copolyamides as Desalination Membranes, W77-09806 3A

Water Purifying Systems, W77-09808 5F

Acoustical Wave Flowmeter, W77-09809 7B

Underground Irrigation Porous Pipe, W77-09810 3F

Traveling Irrigation Sprinkler, W77-09811 3F

Detoxification of Aqueous Waste Streams Containing Cyanide, W77-09812 5D

Method for Detecting Oil in Water, W77-09813 5A

Remote Control for Large-Area Sprinkler Systems, W77-09814 3F

Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D

Semipermeable Membranes and the Method for the Preparation Thereof, W77-09817 3A

Water Treatment System with Prolonged Aeration, W77-09818 5G

Aerating Apparatus, W77-09819 5G

Liquid Filtering Apparatus, W77-09820 5D

Gravitational Separator, W77-09821 5D

SUBJECT INDEX

Continuous Composting of Organic W W Waste-by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E

Highly Efficient Aerating System-For An Activated Sludge Effluent Treatment Plant, with Restricted Liquid Circulation in Aerating Tank. W77-09844 5D

Waste Water Biochemical Purification Control-By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution. W77-09845 5D

PATH OF POLLUTANTS

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B

Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS, W77-09659 5B

Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B

Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils, W77-09966 5B

Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B

Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B

PATHOGENIC BACTERIA

Inactivation by Ionizing Radiation of Salmonella Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D

PATHOGENS

Radiation Treatment of Sewage Sludge-Experience with an Operating Pilot Plant, W77-09876 5D

PATHOLOGY

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, Paralichthys lethostigma, and the Sea Catfish, Arius felis, W77-09780 5C

PEACHES

Irrigation Requirements of Mature Peach Trees Under Microjets (Besproeiingsbehoeftes van volwasse perskebome onder mikrospruite), W77-10079 3F

PEAT

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

Degradation of a Nonionic Surfactant in Soils and Peat, W77-09638 5B

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

PENMAN'S EQUATION

On Penman's Equation for Estimating Regional Evaporation, W77-09953 2D

PENTACHLOROPHENOL

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

PERFORMANCE

Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant, W77-09854 5D

Hydrogen Peroxide Subdues Waste Water Plant Problems, W77-09858 5D

Making Sure of Pipeline Performance, W77-10068 8A

PERIPHYTON

Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

PESTICIDES

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

PERITRICHIA

Urceolids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian), W77-09936 2H

PERMISSIBLE LEVELS

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

PERU-CHILE TRENCH (SO AMER)

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

PERU (MAJES IRRIGATION SCHEME)

Through the Andes, W77-09687 8A

PESTICIDE RESIDUES

A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C

PESTICIDES

A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, Umbra pygmaea (DeKay), W77-09670 5C

The Effect of Mirex on the Burrowing Activity of the Lugworm (Arenicola Cristata), W77-09675 5C

Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

SUBJECT INDEX

PETROLEUM HYDROCARBONS

PETROLEUM HYDROCARBONS

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

PETROLEUM REFINERS

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

PHAEODACTYLUM

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

PHENOLS

Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

PHOSPHATE ADSORPTION (SOILS)

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

PHOSPHATE REMOVAL

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

PHOSPHATES

Nitrate and Phosphate Content of Ground and Surface Waters of the White River Drainage, Northwest Nebraska, W77-09743 5B

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2I

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G

Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

PHOSPHORUS

Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D

Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

Evaluation of the Parameters of Soil Phosphorus Availability Factors in Predicting Yield Response and Phosphorus Uptake, W77-09646 2G

Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment, W77-09847 5D

Low Cost Phosphorus Removal at Reno-Sparks, Nevada, W77-09849 5D

Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers, W77-09904 5A

Nitrogen, Phosphorus, and Potassium Utilization in the Plant-Soil System: An Analytical Model, W77-09964 2I

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

Algal Nutrient Availability and Limitation in Lake Ontario During IFGYL. Part I, Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters, W77-10052 5C

PHOSPHORUS COMPOUNDS

Controlling the Access of Nutrients from Point and Diffused Sources with Special Reference to the Pretoria/Witwatersrand/Vereeniging Region, W77-10082 5G

PHOSPHORUS SOLUBILIZATION (SOILS)

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

PHOSPHORUS UPTAKE (SOILS)

Evaluation of the Parameters of Soil Phosphorus Availability Factors in Predicting Yield Response and Phosphorus Uptake, W77-09646 2G

PHOTOINACTIVATION

Disinfection of Waste Water by Photodynamic Oxidation, W77-09652 5D

PHOTOSYNTHESIS

Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C

Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C

Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

Determining Photosynthetic Productivity in Streams, W77-10080 5C

PHYLOGENY

Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C

PHYSIOLOGY

The Freshwater Mussel (Anodonta SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

PHYTOPLANKTON

Effect of Organic Excretion by Benthic Annelids on the Productivity of Phytoplankton, W77-09660 5C

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Environmental Status of the Lake Michigan Region: Vol. 4. Phytoplankton of Lake Michigan, W77-10056 5C

PICLORAM DEGRADATION (SOILS)

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

PIERS

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

SUBJECT INDEX

POLLUTANT IDENTIFICATION

- Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill), W77-10041 8B
- PILOT PLANTS**
Radiation Treatment of Sewage Sludge--Experience with an Operating Pilot Plant, W77-09876 5D
- PINYON PINE TREES**
Vegetation Manipulation--A Case Study of the Pinon-Juniper Type, W77-09959 4C
- PIPELINES**
Making Sure of Pipeline Performance, W77-10068 8A
Proposed Pipeline System Will Link Water Schemes DWA's R24 Million Balancing Act, W77-10069 8B
- PIPES**
Underground Irrigation Porous Pipe, W77-09810 3F
Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanälen und-leitungen), W77-09833 8G
New Sewer System Resists Infiltration, W77-09843 5D
- PIPING**
Corrosion Avoidance in Water and Sewage Pipelines, W77-09832 8F
- PLANKTON**
Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian), W77-10010 5C
Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish), W77-10066 2L
- PLANNING**
Advance Sewer Planning for Rio de Janeiro Coastline, W77-09890 5D
- PLANT GROWTH**
Growth of Tulips Treated with Sludge Containing Dewatering Chemicals, W77-09867 5E
- PLANT GROWTH**
Elemental Composition of Sludge-Fertilized Chrysanthemums, W77-09868 5E
Radiation Treatment of Sewage Sludge--Experience with an Operating Pilot Plant, W77-09876 5D
Crop Temperature Modification and Yield Potential in a Dwarf Spring Wheat, W77-09939 3F
Simulation of Plant Growth by Humic Substances, W77-09963 2I
Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G
- The Effect of Copper on Competition Between Marine Algae, W77-10051 5C
Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A
- PLANT MORPHOLOGY**
Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C
- PLANT POPULATIONS**
Diatoms in Pond Plankton: Relationships to Epiphytic and Epipellic Populations, W77-09628 5C
- PLANTING MANAGEMENT**
Crop Temperature Modification and Yield Potential in a Dwarf Spring Wheat, W77-09939 3F
- PLASTICS**
Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D
PVC Lining--The Answer to Corrosive Attack by H2S in Concrete Sewers and Structures, W77-09835 8G
Watertight Case for Pond Liners, W77-09891 5G
- PLUTONIUM**
Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B
- POHJANPITAJANLAHTI BAY (FINLAND)**
Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L
- POISSON RATIO**
Return Periods of Hydrological Events, W77-09958 2B
- POLLUTANT IDENTIFICATION**
A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A
A Quantitative Method for Toxaphene by GC-CI-MS Specific Ion Monitoring, W77-09633 5A
Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A
Water System Virus Detection, W77-09636 5A
Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G
The Effect of Tricain Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C
Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C
Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A
Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A
Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A
Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A
Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A
Determination of Arsenic Species in Natural Waters, W77-09747 5A
Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A
Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A
Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K
Determination of Nitrotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A
Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A
Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K
The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A
Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A
Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A
Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C
Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A
Method for Detecting Oil in Water, W77-09813 5A

SUBJECT INDEX

POLLUTANT IDENTIFICATION

- Experiences with the Organic Carbon Analyzer (TOC) by Merz for Routine Monitoring at the BASF Purification Plant (Erfahrungen mit dem TOC-Schnellbestimmer nach Merz in der Routineüberwachung der BASF), W77-09894 5A
- Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A
- Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A
- The Fate of Pollutants in Subsurface Environments, W77-09915 5B
- Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A
- Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter, W77-09971 2G
- Oil Spill Identification System, W77-10024 5A
- Mercury Detection Simplified, W77-10084 5A
- Parameters which Influence the Organic Carbon Determination in Water, W77-10092 5A
- Microcystis Toxins: Isolation, Identification, Implications, W77-10093 5A
- Dehydration of Marine Zoological Material - Volatility of Metabolised Selenium at 105-120C, W77-10095 5A
- POLLUTION ABATEMENT**
- Urban Runoff Pollution Control-Technology Overview, W77-09823 5D
- Chicago Plan Designed for Pollution and Flood Control, W77-09838 4A
- Impact on Marine Benthos of Waste Water Discharge, W77-09846 5C
- Cross Canada Report, W77-09923 5G
- POLYCHAETES**
- Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C
- POLYCHLORINATED BIPHENYLS**
- Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C
- Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A
- Effects of Aroclor (R) 1254 on Brook Trout, *Salvelinus Fontinalis*, W77-09783 5C

POLYELECTROLYTES

- Nirmali Seed-A Naturally Occurring Coagulant, W77-09861 5D

POLYMERS

- Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D
- Polymer Addition Improves Waste Water Treatment Process, W77-09878 5D

PONDS

- Diatoms in Pond Plankton: Relationships to Epiphytic and Epipellic Populations, W77-09628 5C
- Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

POPULATION

- Oligochaeta of the Deniester River Mouth Region, (In Russian), W77-10065 2L

PORE PRESSURE

- Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

PORE WATER

- A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

POROUS PIPES

- Underground Irrigation Porous Pipe, W77-09810 3F

PORT WASHINGTON HARBOR (WISC)

- Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

- Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09990 8B

POTABLE WATER

- Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A
- Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

POTASSIUM

- Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KCl, W77-09641 3F

- Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

- Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers, W77-09904 5A

- Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments, W77-09962 2G

- Nitrogen, Phosphorus, and Potassium Utilization in the Plant-Soil System: An Analytical Model, W77-09964 2I

- Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G

POTATO WASTES

- Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C

PRAIRIE GROVE LAKE (ARK)

- Bottom Withdrawal can Enhance Lake Water Quality, W77-10049 5G

PRECIPITATION (ATMOSPHERIC)

- Precipitation Trend and Storm Analysis in Colorado, W77-09685 2C

- Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements, W77-09720 2B

- Rainfall Trends in 80 Rainfall Districts of South Africa, W77-10085 2B

- On the Application of Trend Surfaces of Precipitation to Mountainous Areas, W77-10088 2B

PREFERENCE

- Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

PRESSURE SEWERS

- Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D

PRIMARY PRODUCTIVITY

- An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C

- Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

- Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C

- Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

- Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

PRODUCTIVITY

- Determining Photosynthetic Productivity in Streams, W77-10080 5C

PROGRAMS

- Water Quality Program of the U.S. Geological Survey, W77-10006 5A

SUBJECT INDEX

RAINFALL DISPOSITION

PROJECTS

Federal Plan for Acquisition of Water Data by Federal Agencies, Fiscal Year 1977.
W77-10013 7C

PROPELLANTS

Catalytic Deoxygenation of Aqueous Solutions by Hydrazine,
W77-09766 5B

PROTEIN

Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes,
W77-09785 5C

PROTOTYPE TESTS

Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation,
W77-10019 8B

PROTOZOA

Observations on the Intestinal Protozoa Infecting Man in Rhodesia,
W77-09691 5F

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford,
W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report,
W77-09762 5C

Urceolarians (Ciliata, Peritricha) from Fishes of the Urals, (In Russian),
W77-09936 2H

Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian),
W77-10010 5C

Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia,
W77-10076 5G

PRUDHOE BAY CRUDE OIL

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food,
W77-09683 5C

PUBLIC HEALTH

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko),
W77-09690 5G

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents,
W77-09770 5B

Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia,
W77-10076 5G

PULP AND PAPER INDUSTRY

Relationship of Effluent Limitations to Future Pulp Mill Closures,
W77-09727 5D

Fiberboard Mill Recycles Water.
W77-09728 5D

How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera),
W77-09738 3E

Closed-Cycle Mill Eliminates Pollution While Also Saving Money,
W77-09740 3E

Water Reuse in a Paper Reprocessing Plant,
W77-09757 5D

PULP WASTES

Relationship of Effluent Limitations to Future Pulp Mill Closures,
W77-09727 5D

Fiberboard Mill Recycles Water.
W77-09728 5D

Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent,
W77-09729 5A

Characterization of Spent Bleaching Liquors. Part 1, Spent Liquors from the Chlorine and Alkali Extraction Stages in the Prebleaching of Pine Kraft Pulp,
W77-09731 5A

Brown (Co.) Recycles De-inking Water on Tissue-Grade Products,
W77-09732 5D

Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W77-09733 5D

Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioactive Indicator (On the Example of Lake Baikal), (In Russian),
W77-09735 5B

Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie),
W77-09736 5A

Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect,
W77-09737 5E

Effluents of Kraft Mills and Their Toxicity for Hydrobionts (Stokhnye vody sul'fat-tsellyuloznykh zavodov i ikh toksichnost' dlya gidrobiontov),
W77-09739 5C

Closed-Cycle Mill Eliminates Pollution While Also Saving Money,
W77-09740 3E

Paper Mill Wastewater Treatment by Microstraining,
W77-09758 5D

PUMPED STORAGE

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation,
W77-09987 8B

Hydro-Electric Development of the Tugela River,
W77-10073 8C

PUMPING

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology,
W77-09952 4B

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation,
W77-10043 8B

PUMPING PLANTS

Analysis of Economic Sewage Lift Station Design,
W77-09906 8C

PUMPS

How a Heat Pump Improved Water Conditions at a Fish Hatchery,
W77-09791 5C

Gear Motor Solves Plant's Noise Problem.
W77-09827 8C

Design Proposals for Submersible Sewage Lift Stations,
W77-09839 8C

PURPLE HERON

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain),
W77-09677 5A

PYRAMID LAKE (NEV)

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling,
W77-09701 2J

QUINALDINE SULPHATES

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol,
W77-09662 5C

RADAR

Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements,
W77-09720 2B

RADFORD ARMY AMMUNITION PLANT

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford,
W77-09761 5C

RAINDROPS

Acceleration to Terminal Velocity of Cloud and Raindrops,
W77-09719 2B

RAINFALL

Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974),
W77-09693 7C

Rainfall Trends in 80 Rainfall Districts of South Africa,
W77-10085 2B

On the Application of Trend Surfaces of Precipitation to Mountainous Areas,
W77-10088 2B

The Temporal Variation of Rainfall Runoff Over the Summer Rainfall Region of South Africa,
W77-10091 2B

RAINFALL DISPOSITION

Temporally and Areally Distributed Rainfall,
W77-09696 2B

SUBJECT INDEX

RAINFALL DISPOSITION

RAINFALL DISTRIBUTION

- Temporally and Areally Distributed Rainfall,
W77-09696 2B

RAINFALL INTENSITY

- Temporally and Areally Distributed Rainfall,
W77-09696 2B

RAINFALL MAPS

- Satellite-Derived Global Oceanic Rainfall Atlas
(1973 and 1974),
W77-09693 7C

RAINFALL-RUNOFF MODELS

- Application of the U.S. Geological Survey
Rainfall Runoff Simulation Model to Improve
Flood-Frequency Estimates on Small Tennessee
Streams,
W77-10004 2A

RANCE ESTUARY (FRANCE)

- Effect of Organic Excretion by Benthic
Annelids on the Productivity of Phytoplankton,
W77-09660 5C

RANGE MANAGEMENT

- Vegetation Manipulation--A Case Study of the
Pinyon-Juniper Type,
W77-09959 4C

REACTION RATES

- Catalytic Deoxygenation of Aqueous Solutions
by Hydrazine,
W77-09766 5B

RECREATION DEMAND

- The Functional and Aesthetic Uses of Two
Cache Valley, Utah, Canals,
W77-09796 6B

RECYCLING

- The Renovation and Re-Use of Wastewater,
W77-09686 5D
Fiberboard Mill Recycles Water.
W77-09728 5D
Brown (Co.) Recycles De-inking Water on Tissue-Grade Products,
W77-09732 5D
Closed-Cycle Mill Eliminates Pollution While Also Saving Money,
W77-09740 3E
Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment,
W77-09847 5D

REDEAR SUNFISH

- Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish,
W77-09786 5C

REED-BANKS (LAKES)

- Intensive Large City Influence on Reed-Banks, (In German),
W77-09621 5C

REFLECTANCE

- Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop,
W77-09942 2D

REFORESTATION

- Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality.
W77-09756 5G

REGIONAL ANALYSIS

- On Penman's Equation for Estimating Regional Evaporation,
W77-09953 2D

REGIONAL EVAPORATION

- On Penman's Equation for Estimating Regional Evaporation,
W77-09953 2D

REMOTE CONTROL

- Remote Control for Large-Area Sprinkler Systems,
W77-09814 3F

REMOTE SENSING

- Classifying and Monitoring Water Quality by Use of Satellite Imagery,
W77-09634 5A

- An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content,
W77-09957 2G

- The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing,
W77-10007 2H

RENAL EXCRETION

- Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol,
W77-09662 5C

REPRODUCTION

- Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell,
W77-09673 5C

RESEARCH PRIORITIES

- The Case for the Expanded Study of Freshwater Pollution Zoology,
W77-10086 5C

RESERVOIR OPERATION

- Optimal Operation of Flood Control Systems, (Final Report; V.II),
W77-09927 4A

- Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation,
W77-09943 4A

RESERVOIRS

- Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian),
W77-09610 2H

- The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba,
W77-09614 5C

- Chicago Plan Designed for Pollution and Flood Control.
W77-09838 4A

- Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation,
W77-09987 8B

- Bottom Withdrawal can Enhance Lake Water Quality.
W77-10049 5G

RESISTIVITY

- Electrical Water Prospecting.
W77-10100 2F

RESOURCES DEVELOPMENT

- Potential Environmental Consequences of Tertiary Oil Recovery,
W77-10023 5C

- Identification and Analysis of Mid-Atlantic Onshore OCS Impacts.
W77-10027 5C

RETURN PERIODS

- Return Periods of Hydrological Events,
W77-09958 2B

REVERSE OSMOSIS

- Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego),
W77-09733 5D

- Regular Copolyamides as Desalination Membranes,
W77-09806 3A

- Semipermeable Membranes and the Method for the Preparation Thereof,
W77-09817 3A

- Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation,
W77-09863 5D

- Application of Membrane Processes,
W77-09929 3A

REVIEWS

- Logging Roads and Protection of Water Quality.
W77-09725 5G

- Effluents of Kraft Mills and Their Toxicity for Hydrobiota (Stochne vody sul'fat-tsellyuloznykh zavodov i ikh toksichnost' dlya gidrobiontov),
W77-09739 5C

- Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality.
W77-09756 5G

- Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents,
W77-09770 5B

- Wastewater Microbiology,
W77-09893 5D

RHINICHTHYS

- Immediate Behavioral Reactions of Blacknose Dace, Rhinichthys atratulus, to Domestic Sewage and its Toxic Constituents,
W77-09669 5C

RHODE ISLAND

- An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island,
W77-09637 2F

RHODESIA

- Observations on the Intestinal Protozoa Infecting Man in Rhodesia,
W77-09691 5F

- Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia,
W77-10076 5G

- The Darwendale Reservoir as a Fishery,
W77-10096 2H

RIP CURRENTS

- The Causes of Erosion to Siletz Spit, Oregon,
W77-10039 2L

RISKS

- Impact of Economic Risks on Box Culvert Designs—An Application to 22 Virginia Sites, W77-10067 8B

RIVER MOUTHS

- Sediment Transport and Deposition at River Mouths: A Synthesis, W77-09705 2J

RIVERS

- Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

- Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C

- Sediment Transport and Deposition at River Mouths: A Synthesis, W77-09705 2J

- Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

- Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

ROAD CONSTRUCTION

- Logging Roads and Protection of Water Quality, W77-09725 5G

ROADS

- Logging Roads and Protection of Water Quality, W77-09725 5G

ROCKY MOUNTAIN ARSENAL (COLO)

- Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B

ROOTED AQUATIC PLANTS

- Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

ROTATING FLIGHTED CYLINDER

- Application of the Rotating Flighted Cylinder to Livestock Waste Management, W77-09795 5D

ROTATIONS

- Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield, W77-09969 3F

ROTIFERS

- Characteristics of the Zooplankton of the Lower Reaches of the Irgiz and Turgay Rivers, (In Russian), W77-09940 5C

ROUGHNESS (HYDRAULIC)

- Brink Depth Method in Rectangular Channel, W77-09695 8B

RUACANA SCHEME (SWA)

- Tunnelling Work for the Ruacana Scheme, W77-09688 8A

RUBBLE-MOUND BREAKWATERS

- Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation, W77-09984 8B

SAHARA DESERT

- Stabilization of Sand Dunes in the West Sahara, W77-10074 4A

SAHEL

- Arid Lands of Sub-Saharan Africa, W77-09934 6E

SALINE SOILS

- Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian), W77-09630 3C

SALINE WATER

- Colorado River Basin Salinity Control Project—Title I, W77-09931 5D

SALINITY

- The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of *Serpula vermicularis* L. (Annelida: Polychaeta), W77-09684 5C

- Effect of Leaching Fraction on River Salinity, W77-09697 5G

- Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L

- Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

- Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B

- Oligochaeta of the Deniester River Mouth Region, (In Russian), W77-10065 2L

SALMON

- Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

SALMONELLA

- Inactivation by Ionizing Radiation of *Salmonella enteritidis* Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D

SALMONIDS

- The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I

SALT BALANCE

- Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

SALT BUDGET

- Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

SALT MARSHES

- Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

- Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B

- Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil, W77-10035 2L

SALTS

- Estimating the Water and Salt Budgets of a Stratified Estuary, W77-09709 2L

SAMPLING

- A Simple Hand Corer for Shallow Water Sampling, W77-09715 7B

- Oceanographic Water Sampler, W77-09799 7B

- Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations, W77-09974 2G

- The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

SAN GABRIEL RIVER (TEX)

- North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B

SAND BARS

- Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway, W77-09699 2J

SAND WAVES

- Effect of Slope on the Threshold of Motion and Its Application to Orientation of Wind Ripples, W77-09955 2J

SANDS

- Influence of Cation Content on the Biological Activity of Fensulfothion in Plainfield Sand, W77-09639 2G

- The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I

- Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G

SANDSTONES

- Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway, W77-09699 2J

SANDVIS BAY

- A Check List and Notes on the Birds of Sandvis, South West Africa, W77-10089 2L

SANITARY ENGINEERING

- Some Effects of Lime Addition on High Solids, Completely Mixed, Activated Sludge Waste Water Treatment, W77-09601 5D

- City of Minnetonka Wing Lake Trunk Sewer: City of Minnetonka, Minnesota, W77-09842 5D

SUBJECT INDEX

SATELLITES

SATELLITES

Classifying and Monitoring Water Quality by Use of Satellite Imagery,
W77-09634 5A

SCHISTOSOMIASIS

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko),
W77-09690 5G

SEA CATFISH

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, Paralichthys lethostigma, and the Sea Catfish, Arius felis,
W77-09780 5C

SEA WATER

A Unique Means of Obtaining Sea-Water,
W77-09692 8E

Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry,
W77-09750 2K

The Determination of Molybdenum and Tungsten in Sea and Surface Water,
W77-09754 5A

Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine,
W77-09793 5C

Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance,
W77-09945 5A

SEALANTS

Studies on the Reclamation of Stone Lake, Michigan,
W77-09605 5G

SEASONAL

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie,
W77-09986 8B

SEDIMENT

Sediment Transport and Deposition at River Mouths: A Synthesis,
W77-09705 2J

SEDIMENT CORERS

A Simple Hand Corer for Shallow Water Sampling,
W77-09715 7B

SEDIMENT DEPOSITION

Sediment Transport and Deposition at River Mouths: A Synthesis,
W77-09705 2J

SEDIMENT DISCHARGE

Sediment Transport and Deposition at River Mouths: A Synthesis,
W77-09705 2J

SEDIMENT SORTING

Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England,
W77-09700 2J

SEDIMENT TRANSPORT

Sediment Transport and Deposition at River Mouths: A Synthesis,
W77-09705 2J

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75,
W77-09982 2L

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal,
W77-10029 2L

SEDIMENT-WATER INTERFACE

Competition for Mercury Between River Sediment and Bacteria,
W77-09661 5B

SEDIMENTARY NUTRIENTS

Studies on the Reclamation of Stone Lake, Michigan,
W77-09605 5G

SEDIMENTATION

Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway,
W77-09699 2J

Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England,
W77-09700 2J

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling,
W77-09701 2J

Two-Stage Settling Improves Sludge Removal Efficiency,
W77-09875 5D

The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill,
W77-09950 2J

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75,
W77-09982 2L

Current Dynamics and Sediment Distribution in the West Mississippi Delta Area,
W77-10032 2L

SEDIMENTATION RATES

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling,
W77-09701 2J

Sedimentation Rates in a Coastal Marsh Determined from Historical Records,
W77-09713 2J

SEDIMENTOLOGY

Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England,
W77-09700 2J

SEDIMENTS

The Role of Humic Acids in the Uptake and Release of Mercury by Freshwater Sediments,
W77-09615 5B

Competition for Mercury Between River Sediment and Bacteria,
W77-09661 5B

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions,
W77-09676 5B

North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present,
W77-09706 2J

Sedimentation Rates in a Coastal Marsh Determined from Historical Records,
W77-09713 2J

A Simple Hand Corer for Shallow Water Sampling,
W77-09715 7B

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report,
W77-09763 5C

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria,
W77-09772 5C

Steroids as Sewage Specific Indicators in New York Bight Sediments,
W77-09901 5A

Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site,
W77-09928 5B

SEEPAGE

Seepage from Small Earth Dams,
W77-09932 8D

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska,
W77-10033 5B

SELENIUM

Dehydration of Marine Zoological Material - Volatility of Metabolised Selenium at 105-120C,
W77-10095 5A

SELENIUM

Microbial Formation of Volatile Selenium Compounds in Soil,
W77-09648 2G

SEMIIMPERMEABLE MEMBRANES

Semipermeable Membranes and the Method for the Preparation Thereof,
W77-09817 3A

SENSITIVITY ANALYSIS

Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model,
W77-09981 5B

SEPARATION TECHNIQUES

Application of the Rotating Flighted Cylinder to Livestock Waste Management,
W77-09795 5D

Method of Treating Waste Water Containing Surfactant and Heavy Metals,
W77-09815 5D

Gravitational Separator,
W77-09821 5D

Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation,
W77-09825 5D

Continuous Filter Press,
W77-09826 5D

Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment,
W77-09847 5D

Low Cost Phosphorus Removal at Reno-Sparks, Nevada,
W77-09849 5D

SUBJECT INDEX

SLUDGE DISPOSAL

- Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D
- SEPTIC TANKS**
Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B
- SERPULA**
The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of *Serpula Vermicularis* L. (Annelida: Polychaeta), W77-09684 5C
- SETTLING BASINS**
Gravitational Separator, W77-09821 5D
Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D
- SETTLING VELOCITY**
Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L
- SEWAGE**
Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C
Analysis of Economic Sewage Lift Station Design, W77-09906 8C
- SEWAGE DISPOSAL**
Intensive Large City Influence on Reed-Banks, (In German), W77-09621 5C
Chellaston Trunk Foul Sewer. Some Interesting Aspects of the Scheme, W77-09837 5D
- SEWAGE EFFLUENTS**
Mixer Cuts Solids Up and Time Down for Waste Treatment, W77-09885 5D
Productivity of *Clarias* *Batrachus* in the Sewage Fertilized Fish Ponds, W77-09922 5C
- SEWAGE EJECTORS (HYDRAULIC)**
Sewage Ejectors Avoid Manual Unblocking of Pipes, W77-09856 8C
- SEWAGE LAGOONS**
Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase I, W77-10061 5C
- SEWAGE TREATMENT**
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
Method and Apparatus for Aerobic Sewage Treatment, W77-09805 5D
Sewage Ejectors Avoid Manual Unblocking of Pipes, W77-09856 8C
- Oxidation Ditch Gives Low-Cost Secondary Treatment, W77-09866 5D
Study of the Decomposition of Organic Matter by the Respirometric Dilution Method (Untersuchungen ueber das Abbauverhalten organischer Stoffe mit Hilfe der respirometrischen Verdunnungsmethode), W77-09888 5D
Chemical Treatment of Sewage, W77-09892 5D
- SEWER CONSTRUCTION**
Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D
- SEWERS**
Corrosion Avoidance in Water and Sewage Pipelines, W77-09832 8F
Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanalen und-leitungen), W77-09833 8G
Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D
Chellaston Trunk Foul Sewer. Some Interesting Aspects of the Scheme, W77-09837 5D
Design Proposals for Submersible Sewage Lift Stations, W77-09839 8C
Pennsylvania Waste Water Project Progresses Quickly, W77-09840 5D
Critical and Brink Depths in Elliptical Sewers, W77-09841 8B
City of Minnetonka Wing Lake Trunk Sewer: City of Minnetonka, Minnesota, W77-09842 5D
New Sewer System Resists Infiltration, W77-09843 5D
Hydrogen Peroxide Subdues Waste Water Plant Problems, W77-09858 5D
Saffron Walden Opens Its Low Profile Sewage Works, W77-09872 5D
Advance Sewer Planning for Rio de Janeiro Coastline, W77-09890 5D
Lacey, Olympia, Tumwater, and Thurston County Wastewater Treatment, W77-09898 5D
The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B
- SHALLOW MARINE SAND BARS**
Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway, W77-09699 2J
- SHELBYVILLE LAKE (ILL)**
Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation, W77-09943 4A
- SHORE PROTECTION**
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L
- SHRIMP**
The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C
- SHRINKAGE**
The Nature of Changes in Bulk Density with Water Contents in Cracking Clay, W77-09937 2G
- SHRUBS**
Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D
- SILETZ SPIT (ORE)**
The Causes of Erosion to Siletz Spit, Oregon, W77-10039 2L
- SILVER BAY (MINN)**
Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C
- SIMULATION ANALYSIS**
Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B
Bay Springs Lake Water-Quality Study, W77-10055 5B
- SKELETONEMA**
Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C
- SLOPES**
Effect of Slope on the Threshold of Motion and Its Application to Orientation of Wind Ripples, W77-09955 2J
- SLUDGE**
Elemental Composition of Sludge-Fertilized Chrysanthemums, W77-09868 5E
How Sludge Characteristics Affect Incinerator Design, W77-09869 5E
- SLUDGE DIGESTION**
A New Rapid Digestion Process for Sewage Sludge Utilization (Einneues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klärschlamm-Verwertung), W77-09887 5D
- SLUDGE DISPOSAL**
Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect, W77-09737 5E
Continuous Composting of Organic W W Waste-by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E

SUBJECT INDEX

SLUDGE DISPOSAL

Co-Burning of Sludge and Refuse with Waste Heat Recovery, W77-09857 5E

Growth of Tulips Treated with Sludge Containing Dewatering Chemicals, W77-09867 5E

Land Application of Municipal Sludge, W77-09882 5E

A New Rapid Digestion Process for Sewage Sludge Utilization (Einneues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klaerschlam-Verwertung), W77-09887 5D

Options for Sludge-To Land, Sea or Fire, W77-09918 5E

SLUDGE TREATMENT

Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect, W77-09737 5E

Continuous Filter Press, W77-09826 5D

Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D

How Sludge Characteristics Affect Incinerator Design, W77-09869 5E

Radiation Treatment of Sewage Sludge-Experience with an Operating Pilot Plant, W77-09876 5D

Method for the Determination of the Conditionability of Sewage Sludge (Erarbeitung von Methoden zur Ermittlung der Konditionierbarkeit von Klaerschlaemmen), W77-09884 5D

Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A

Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

SLUDGES

Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers, W77-09904 5A

SLUICE GATES

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

SLUICES

Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

SMALL BOAT BASINS (DESIGN)

Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

SMALL WATERSHEDS

Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve Flood-Frequency Estimates on Small Tennessee Streams, W77-10004 2A

SNAILS

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziasisiko), W77-09690 5G

SNOW

Movement of Snow Avalanches, W77-09716 2C

Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C

SNOW COVER

Mathematical Description of Some Physical Snow Cover Characteristics, W77-09717 2C

SNOW DUST AVALANCHES

Movement of Snow Avalanches, W77-09716 2C

SODIUM

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

SODIUM LAURYL SULPHATE

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (Salmo trutta L.), W77-09672 5C

SODIUM PENTACHLOROPHENOLATE

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C

SOIL AMENDMENTS

Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments, W77-09962 2G

SOIL CHEMICAL PROPERTIES

Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G

SOIL CHEMISTRY

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of CD by Montmorillonite, W77-09658 5B

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

SOIL CLASSIFICATION

Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G

SOIL CONSERVATION

Scientific Bases of a System for Averting Unfavorable Consequences of Steppe Soil Irrigation, (In Russian), W77-10021 2G

SOIL DISPOSAL FIELDS

Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D

Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B

SOIL EROSION

Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D

SOIL FILTERS

Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D

SOIL INVESTIGATION

Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers, W77-09967 2G

SOIL INVESTIGATIONS

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

SOIL MECHANICS

Seepage from Small Earth Dams, W77-09932 8D

SOIL MOISTURE

Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G

SOIL MOISTURE METERS

An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch), W77-09613 2G

SOIL NITRITES

Comments on Nitrate Reduction in Unsaturated Soil, W77-09650 2G

SUBJECT INDEX

SPECTROPHOTOMETRY

SOIL PROFILES

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

SOIL PROPERTIES

Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G

SOIL SEALANTS

Seepage from Small Earth Dams, W77-09932 8D

SOIL TEMPERATURE

Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil, W77-09654 5D

SOIL TESTS

Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G

SOIL TREATMENT

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation, W77-09643 2G

SOIL WATER

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G

Ammonia Volatilization from Surface Applications of Ammonium Compounds on Calcareous Soils: V. Soil Water Content and Method of Nitrogen Application, W77-09960 2G

Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers, W77-09967 2G

Scientific Bases of a System for Averting Unfavorable Consequences of Steppe Soil Irrigation, (In Russian), W77-10021 2G

SOIL WATER MOVEMENT

Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

Degradation of a Nonionic Surfactant in Soils and Peat, W77-09638 5B

Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil, W77-09653 5B

SOLAR RADIATION

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G

SOLUBILITY

Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G

SOLVENTS

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

SOUTH AFRICA

The Renovation and Re-Use of Wastewater, W77-09686 5D

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko), W77-09690 5G

Making Sure of Pipeline Performance, W77-10068 8A

Proposed Pipeline System Will Link Water Schemes DWA's R24 Million Balancing Act, W77-10069 8B

The Dam Busters, W77-10070 8A

Hydro-Electric Development of the Tugela River, W77-10073 8C

Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D

Rainfall Trends in 80 Rainfall Districts of South Africa, W77-10085 2B

The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

SOUTH AMERICA

Through the Andes, W77-09687 8A

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

SOUTH CAROLINA

An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C

Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C

Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B

SOUTH WEST AFRICA

Tunnelling Work for the Ruacana Scheme, W77-09688 8A

SOUTHERN FLOUNDER

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

SOYBEANS

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

SPACE CAPSULES (VIRUS DETECTION)

Water System Virus Detection, W77-09636 5A

SPACING (DRAINS)

Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

SPAIN

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

SPARK SOURCE MASS SPECTROMETRY

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

SPARTINA ALTERNIFLORA

Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil, W77-10035 2L

SPATIAL DISTRIBUTION

Macrophyte-Sediment Relationships in Chautauqua Lake, W77-09612 5C

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

SPAWNING

Ecology of the Azov Vimba, *Vimba vimba* Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H

SPECIES DIVERSITY INDEX

Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A

SPECIFIC SURFACE MEASUREMENT (SOILS)

Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter, W77-09971 2G

SPECIFICATIONS

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

SPECTROPHOTOMETRY

An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch), W77-09613 2G

Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K

SPECTROSCOPY

- Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A

SPILLWAYS

- Design and Operation of Rain Spillways and Rain Overflow Catchment (Entwurf und Betrieb von Regenüberläufen (Ru) und Regenüberlaufbecken (RUB), W77-09822 8B

- North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B

SPOON DUCK

- Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

SPRAY IRRIGATION

- Spray Irrigation-Waste Water Treatment Facility. North Branch Fire District No. 1, West Dover, Vermont. W77-09828 5D

SPRINKLER IRRIGATION

- Self-Regulating Sprinkler, W77-09801 3F

- Rotary Sprinkler Particularly for Use with Low-Energy Water Jets, W77-09802 3F

- Traveling Irrigation Sprinkler, W77-09811 3F

- Remote Control for Large-Area Sprinkler Systems, W77-09814 3F

ST. LAWRENCE RIVER BASIN (OHIO)

- Water Resources Data for Ohio, Water Year 1975--Volume 2. St. Lawrence River Basin. W77-10001 7C

ST. MARGARET'S BAY (NOVA SCOTIA)

- Short Term Variability in Vertical Chlorophyll Structure, W77-09702 2L

STABILIZATION

- Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil, W77-10035 2L

- Stabilization of Sand Dunes in the West Sahara, W77-10074 4A

STANDARDS

- Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

STATIC CALCULATIONS

- Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanal und -leitungen), W77-09833 8G

STATISTICAL METHODS

- Precipitation Trend and Storm Analysis in Colorado. W77-09685 2C

- Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A

STEADY FLOW

- A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties, W77-10008 2F

STEELHEAD TROUT

- The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I

STEROIDS

- Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A

STICKLEBACKS

- The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

STILLING BASINS

- Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B

- Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

STOCHASTIC PROCESSES

- Optimal Operation of Flood Control Systems, (Final Report; V.II), W77-09927 4A

STONEFLIES

- Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), W77-09620 2I

STORM RUNOFF

- Design and Operation of Rain Spillways and Rain Overflow Catchment (Entwurf und Betrieb von Regenüberläufen (Ru) und Regenüberlaufbecken (RUB), W77-09822 8B

STORM WATER

- Storm Water Management Model: Level I--Comparative Evaluation of Storage-Treatment and Other Management Practices, W77-09824 5D

- Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D

STORMS

- Precipitation Trend and Storm Analysis in Colorado. W77-09685 2C

STRAIT OF GEORGIA

- The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

STRAITS

- Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

STRAITS OF MACKINAC (LAKE MICHIGAN-LAKE HURON)

- Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

STRATIFIED FLOW

- Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

STREAM WIDTH-DISCHARGE

- RELATIONSHIP
Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

STREAMFLOW

- Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year, W77-09997 7C

- Computation of Records of Streamflow at Control Structures, W77-10003 2E

- Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

- 1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A

STREAMFLOW COMPUTATIONS

- Computation of Records of Streamflow at Control Structures, W77-10003 2E

STREAMS

- The Origin of Horizontal Laminae in Ephemeral Stream Channel-Fill, W77-09950 2J

STRIP CUTTING

- The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire, W77-09807 4C

STRONTIUM

- Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F

SUBLETHAL EFFECTS

- Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

- Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

SUBSURFACE IRRIGATION

- Underground Irrigation Porous Pipe, W77-09810 3F

SUCCESSION

- Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C

SUBJECT INDEX

TEXAS

SUGARCANE

- Sulfur-Coated Fertilizers for Sugarcane: I.
Plant Response to Sulfur-Coated Urea,
W77-09640 3F

SULFIDES

- Acute Toxic Effects of Petroleum Refinery
Wastewaters on Redear Sunfish,
W77-09786 5C

SULFONATES

- Adsorption of Dodecylbenzene Sulfonate on
NA(+)-Montmorillonite: Effect of Salt Impuri-
ties,
W77-09651 2G

SULFUR-COATED UREAS (SOILS)

- Sulfur-Coated Fertilizers for Sugarcane: II.
Release Characteristics of Sulfur-Coated Urea
and KCl,
W77-09641 3F

- Ammonia Volatilization and Nitrogen Utiliza-
tion from Sulfur-Coated Ureas and Conven-
tional Nitrogen Fertilizers,
W77-09642 3F

SUNFISHES

- Toxicity of Hydrogen Sulfide to Various Life
History Stages of Bluegill (*Lepomis
macrochirus*),
W77-09668 5C

- Effects of Exposure to Heavy Metals on
Selected Fresh Water Fish. Toxicity of Copper,
Cadmium, Chromium and Lead to Eggs and
Fry of Seven Fish Species,
W77-09784 5C

- Acute Toxic Effects of Petroleum Refinery
Wastewaters on Redear Sunfish,
W77-09786 5C

SUPERCritical FLOW

- Convex Chutes in Converging Supercritical
Flow,
W77-10020 8B

SUPERSATURATION

- The Effect of High Concentrations of Dis-
solved Oxygen on Several Species of Pond
Fishes,
W77-09789 5C

- How a Heat Pump Improved Water Conditions
at a Fish Hatchery,
W77-09791 5C

- Annotated Extracts of Some Papers Dealing
with the Measurement and Solubility of Dis-
solved Atmospheric Gases, with Nitrogen Gas
Supersaturation, and with Gas Bubble Disease
in Fish,
W77-09792 5C

- Supersaturation of Atmospheric Gases in the
Coastal Waters of the Gulf of Maine,
W77-09793 5C

SURFACE WATERS

- Water Resources Data for Ohio, Water Year
1975--Volume 1. Ohio River Basin.
W77-10000 7C

- Water Resources Data for Ohio, Water Year
1975--Volume 2. St. Lawrence River Basin.
W77-10001 7C

- Water Resources Data For Wyoming, Water
Year 1975.
W77-10002 7C

- Water Quality Program of the U.S. Geological
Survey,
W77-10006 5A

- Water Resources of the Umatilla Indian Reser-
vation, Oregon,
W77-10011 4A

- 1976 Water-Quality Data in Bear Creek Basin,
Medford, Oregon,
W77-10015 5A

SURFACES

- Evaporation from a Warm, Wavy Surface: A
Laboratory Study,
W77-09954 2D

SURFACTANT DEGRADATION (SOILS)

- Degradation of a Nonionic Surfactant in Soils
and Peat,
W77-09638 5B

SURFACTANTS

- Degradation of a Nonionic Surfactant in Soils
and Peat,
W77-09638 5B

- Method of Treating Waste Water Containing
Surfactant and Heavy Metals,
W77-09815 5D

SURVEYS

- Short Term Variability in Vertical Chlorophyll
Structure,
W77-09702 2L

- Analysis of Data from Biological Surveys of
Streams: Diversity and Sample Size,
W77-09778 5A

SWAMPS

- The Great Dismal Swamp: Management of a
Hydrologic Resource with the Aid of Remote
Sensing,
W77-10007 2H

SYNOPTIC ANALYSIS

- Experiences with the Use of the Aerological
Method in Evaporation Studies in
Northwestern Europe,
W77-09710 2D

SYSTEMATICS

- Melosira Granulata (Ehr.) Ralfs: Morphology
and Ecology of a Cosmopolitan Freshwater
Diatom,
W77-09619 5C

TACONITE TAILINGS

- Taconite Tailings Disposal, Reserve Mining
Company, Silver Bay, Minnesota.
W77-10062 5C

TANKER TERMINALS

- Long Beach Harbor Numerical Analysis of
Harbor Oscillations; Report 2, Alternate Plans
for Pier J Completion and Tanker Terminal
Project,
W77-10040 8B

TAPEWORM

- The Effect of Parasitism on the Toxicity of
Cadmium to the Three-spined Stickleback,
Gasterosteus aculeatus L.,
W77-09666 5C

TEGLER LAKE (GERMANY)

- Intensive Large City Influence on Reed-Banks,
(In German),
W77-09621 5C

TEMPERATURE

- Soil Temperatures and Heat Loss for a Hot
Pipe Network Buried in Irrigated Soil,
W77-09654 5D

TEMPERATURE CONTROL

- Crop Temperature Modification and Yield
Potential in a Dwarf Spring Wheat,
W77-09939 3F

TEMPERATURE DISTRIBUTION

- Buoyant Surface Jets Discharged into a Strong
Crossflow,
W77-09926 5B

TEMPORAL DISTRIBUTION

- Short Term Variability in Vertical Chlorophyll
Structure,
W77-09702 2L

TEMPORALLY DISTRIBUTED RAINFALL

- Temporally and Areally Distributed Rainfall,
W77-09696 2B

TENNESSEE

- Aquatic Field Surveys at Radford, Holston,
Volunteer, and Milan Army Ammunition
Plants, Vol. II - Holston - Final Report,
W77-09762 5C

- Application of the U.S. Geological Survey
Rainfall Runoff Simulation Model to Improve
Flood-Frequency Estimates on Small Tennes-
see Streams,
W77-10004 2A

TENNESSEE-TOMBIGBEE WATERWAY

- Divide Cut Drainage Structures Tennessee-
Tombigbee Waterway Mississippi and
Alabama; Hydraulic Model Investigation,
W77-10046 8B

- Entrance to Upstream Approach Canal,
Gainesville Lock, Tombigbee River, Mississip-
pi and Alabama; Hydraulic Model Investiga-
tion,
W77-10047 8B

TENNESSEE-TOMBIGBEE WATERWAY (ALA- MISS-TENN)

- Bay Springs Lake Water-Quality Study,
W77-10055 5B

TENNESSEE VALLEY AUTHORITY

- Butoxyethanol Ester of 2,4-D for Control of
Eurasian Water Milfoil,
W77-10057 4A

TERMINAL VELOCITY (CLOUDS AND RAINDROPS)

- Acceleration to Terminal Velocity of Cloud and
Raindrops,
W77-09719 2B

TEXAS

- Diatoms in Pond Plankton: Relationships to
Epiphytic and Epipellic Populations,
W77-09628 5C

- Potassium Sources and Availability on a Deep,
Sandy Soil of East Texas,
W77-09972 2G

- Hydraulics and Dynamics of New Corpus
Christi Pass, Texas: A Case History, 1973-75,
W77-09982 2L

- North Fork Lake Spillway San Gabriel River,
Texas; Hydraulic Model Investigation,
W77-10017 8B

SUBJECT INDEX

TEXAS

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

TEXTILES

Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D

Characterization and Treatment of Textile Dyeing Wastewaters, W77-09745 5D

TFM

Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C

Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

The Freshwater Mussel (Anodonta SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

THALASSIOSIRA

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

THERMAL POLLUTION

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

Temperature Effects on Young Yellow Perch, *Perca flavescens* (Mitchill), W77-09773 5C

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian), W77-10010 5C

Simulation Factors Involved in Ocean Thermal Power Plants, W77-10034 5B

THERMAL POWERPLANTS

Simulation Factors Involved in Ocean Thermal Power Plants, W77-10034 5B

THERMAL STRATIFICATION

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

Dickey-Lincoln School Lakes Hydrothermal Model Study: Hydraulic Laboratory Investigation, W77-09987 8B

THERMAL STRESS

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

Temperature Effects on Young Yellow Perch, *Perca flavescens* (Mitchill), W77-09773 5C

THERMAL WATER

Temperature Effects on Young Yellow Perch, *Perca flavescens* (Mitchill), W77-09773 5C

THERMOREGULATION (FISH)

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

THREE-LAYER CIRCULATION

Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L

THUNDERSTORMS

Precipitation Trend and Storm Analysis in Colorado, W77-09685 2C

TIDAL CURRENTS

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

TIDAL INLETS

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

TIDES

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

TILL

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield, W77-09969 3F

TILLAGE PRACTICES

Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield, W77-09969 3F

TISSUE ANALYSIS

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

TISSUE MERCURY CONCENTRATIONS

Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C

TOMBIGBEE RIVER

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

TOP SOIL

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

TOPOGRAPHY

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

TOPSOIL

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil, W77-09930 2G

TOTAL DISSOLVED SOLIDS

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

TOTAL ORGANIC CARBON ANALYZER

Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

TOXAPHENE

A Quantitative Method for Toxaphene by GC-MS Specific Ion Monitoring, W77-09633 5A

TOXIC MECHANISM

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

TOXICITY

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C

The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L., W77-09666 5C

Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

Effluents of Kraft Mills and Their Toxicity for Hydrobionts (Stokhnye vody sul'fat-tsellyuloznykh zavodov i ikh toksichnost' dlya gidrobiontov), W77-09739 5C

SUBJECT INDEX

TRITIUM

Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

The Freshwater Mussel (Anodonta SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975, W77-09769 5A

Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C

Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

TOXINS

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

TRACE ELEMENTS

An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C

Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of Cd by Montmorillonite, W77-09658 5B

Determination of Arsenic Species in Natural Waters, W77-09747 5A

Determination of Free and Total Potential Halofoms in Drinking Water, W77-09748 5A

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B

TRACERS

Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioac-

tive Indicator (On the Example of Lake Baikal), (In Russian), W77-09735 5B

Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C

TRANSMISSION SPECTROSCOPY

Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A

TRANSPIRATION

Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D

A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

TRANSPIRATION CONTROL

Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

TRANSPORT RATES

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

TRANSVAAL

Proposed Pipeline System Will Link Water Schemes DWA's R24 Million Balancing Act, W77-10069 8B

TRAVELING SPRINKLER

Traveling Irrigation Sprinkler, W77-09811 3F

TREATMENT FACILITIES

Paper Mill Wastewater Treatment by Microstraining, W77-09758 5D

Gear Motor Solves Plant's Noise Problem, W77-09827 8C

Spray Irrigation-Waste Water Treatment Facility. North Branch Fire District No. 1, West Dover, Vermont, W77-09828 5D

Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D

Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant, W77-09854 5D

Hydrogen Peroxide Subdues Waste Water Plant Problems, W77-09858 5D

Thurrock Test-Bed for ICI Deep Shaft, W77-09859 5D

Waste Purification Process, W77-09865 5D

Oxidation Ditch Gives Low-Cost Secondary Treatment, W77-09866 5D

Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D

Saffron Walden Opens Its Low Profile Sewage Works, W77-09872 5D

Radiation Treatment of Sewage Sludge-Experience with an Operating Pilot Plant, W77-09876 5D

Polymer Addition Improves Waste Water Treatment Process, W77-09878 5D

New Wastewater Treatment Systems, W77-09886 5D

Purification Plant Project, W77-09889 5D

Advance Sewer Planning for Rio de Janeiro Coastline, W77-09890 5D

Effluent Treatment Versus Disposal Through Long Sea Outfalls, W77-09895 5E

Lacey, Olympia, Tumwater, and Thurston County Wastewater Treatment, W77-09898 5D

Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

Aeration: Proper Sizing is Critical, W77-09905 5D

The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

Construction Management for Waste Water-treatment Plants, W77-09920 5D

Cross Canada Report, W77-09923 5G

Clarifier for Underground Use, W77-10081 5D

TREES

Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D

TREMATODES

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*, W77-09780 5C

TRICAINE METHANESULFONATE

The Effect of Tricaine Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

TRICHOPTERA

Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), W77-09620 2I

TRINITY SOILS

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

TRITIUM

Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B

SUBJECT INDEX

TRITIUM

TROPHIC LEVEL

Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C

Classifying and Monitoring Water Quality by Use of Satellite Imagery, W77-09634 5A

TROPICAL SOILS

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

TROUT

Influence of Certain Water Conditions, Especially Dissolved Gases, on Trout, W77-09790 5C

TSIMLYANSK RESERVOIR (USSR)

Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H

TSUNAMIS

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude Along the Pacific Coast of the Continental United States, W77-09983 2L

TUGELA RIVER (NATAL)

Hydro-Electric Development of the Tugela River, W77-10073 8C

TUGELA RIVER-VAAL RIVER WATER SCHEME (SO AFR)

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko), W77-09690 5G

TUNGSTEN

The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A

TUNNEL CONSTRUCTION

Through the Andes, W77-09687 8A

The Day They Almost Abandoned the Orange-Fish Tunnel, W77-10077 8A

TUNNEL DESIGN

Through the Andes, W77-09687 8A

TUNNELLING

A Unique Means of Obtaining Sea-Water, W77-09692 8E

TUNNELS

Chicago Plan Designed for Pollution and Flood Control, W77-09838 4A

TURF GRASSES

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass, W77-09978 3C

ULTRAFILTRATION

Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwróconej osmozy i ultrafiltracji do oczyszczania ścieków z przemysłu celulozowo-papierniczego), W77-09733 5D

UMATILLA INDIAN RESERVATION (ORE)

Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A

UNDERGROUND STRUCTURES

Clarifier for Underground Use, W77-10081 5D

UNDERWATER

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

UNDERWATER HABITATS (SUBLIMNOS)

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

UNITED STATES

Federal Plan for Acquisition of Water Data by Federal Agencies, Fiscal Year 1977, W77-10013 7C

UNSATURATED SOILS

Comments on Nitrate Reduction in Unsaturated Soil, W77-09650 2G

UNSTEADY FLOW

Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

URANIUM RADIOISOTOPES

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

URBAN RUNOFF

Urban Runoff Pollution Control-Technology Overview, W77-09823 5D

URCEOLARIIDS

Urceolarids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian), W77-09936 2H

UREAS

Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers, W77-09642 3F

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass, W77-09978 3C

USSR

Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H

Movement of Snow Avalanches, W77-09716 2C

Mathematical Description of Some Physical Snow Cover Characteristics, W77-09717 2C

Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioactive Indicator (On the Example of Lake Baikal), (In Russian), W77-09735 5B

Urceolarids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian), W77-09936 2H

USSR (DUKANT RIVER BASIN)

Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C

USSR (IVAN'KOVSKY RESERVOIR)

Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian), W77-10010 5C

USSR (KAZAKH SSR)

Characteristics of the Zooplankton of the Lower Reaches of the Irgiz and Turgay Rivers, (In Russian), W77-09940 5C

USSR (NORTHEAST CHERNIGOV TERRITORY)

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

USSR (NORTHERN MUGAN)

Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian), W77-09630 3C

UTAH

Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J

The Functional and Aesthetic Uses of Two Cache Valley, Utah, Canals, W77-09796 6B

VACUUM SEWERS

Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D

VAPOR COMPRESSION DISTILLATION

Distillation Apparatus and Method, W77-09804 3A

VEGETATION

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

Sedimentation Rates in a Coastal Marsh Determined from Historical Records, W77-09713 2J

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

SUBJECT INDEX

WASTE WATER TREATMENT

VEGETATION EFFECTS

- Vegetation Manipulation--A Case Study of the Pinyon-Juniper Type, W77-09959 4C

VEGETATION ESTABLISHMENT

- Vegetation Manipulation--A Case Study of the Pinyon-Juniper Type, W77-09959 4C

VEGETATION MANIPULATION

- Vegetation Manipulation--A Case Study of the Pinyon-Juniper Type, W77-09959 4C

VELOCITY

- Acceleration to Terminal Velocity of Cloud and Raindrops, W77-09719 2B

VERTICAL PROFILES (CHLOROPHYLL)

- Short Term Variability in Vertical Chlorophyll Structure, W77-09702 2L

VICINAL WATER

- A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

VIMBA

- Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H

VIRGINIA

- A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L

- Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

- Impact of Economic Risks on Box Culvert Designs--An Application to 22 Virginia Sites, W77-10067 8B

VIRICIDES

- Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A

VIRUSES

- Water System Virus Detection, W77-09636 5A

- Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D

- Photodynamic Inactivation of Infectious Agents, W77-09883 5D

- Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A

WALES (PLYNLIMON)

- A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

WALES (SOUTH)

- The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

WASHINGTON

- Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

WASTE ASSIMILATIVE CAPACITY

- Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

WASTE DILUTION

- Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioactive Indicator (On the Example of Lake Baikal), (In Russian), W77-09735 5B

WASTE DISPOSAL

- A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

- Continuous Composting of Organic W W Waste--by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E

- Co-Burning of Sludge and Refuse with Waste Heat Recovery, W77-09857 5E

- Growth of Tulips Treated with Sludge Containing Dewatering Chemicals, W77-09867 5E

- Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

- Effluent Treatment Versus Disposal Through Long Sea Outfalls, W77-09895 5E

- The Handling of Nitrogenous Wastes in Rural India, W77-09900 5D

WASTE DUMPS

- Taconite Tailings Disposal, Reserve Mining Company, Silver Bay, Minnesota, W77-10062 5C

WASTE IDENTIFICATION

- Using O(xygen) Demand (index), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A

- Characterization of Spent Bleaching Liquors. Part 1. Spent Liquors from the Chlorine and Alkali Extraction Stages in the Prebleaching of Pine Kraft Pulp, W77-09731 5A

- Oil Spill Identification System, W77-10024 5A

WASTE LOADING FUNCTIONS

- Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

WASTE TREATMENT

- A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

- Application of the Rotating Flighted Cylinder to Livestock Waste Management, W77-09795 5D

- Fermentation Technology, W77-09896 5D

WASTE WATER DISPOSAL

- Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil, W77-09654 5D

- Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B

WASTE WATER DIVERSION

- Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G

WASTE WATER TREATMENT

- Some Effects of Lime Addition on High Solids, Completely Mixed, Activated Sludge Waste Water Treatment, W77-09601 5D

- Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D

- Wastewater Treatment by Natural and Artificial Marshes, W77-09606 5D

- Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

- The Renovation and Re-Use of Wastewater, W77-09686 5D

- Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

- Brown (Co.) Recycles De-inking Water on Tissue-Grade Products, W77-09732 5D

- Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego), W77-09733 5D

- Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D

- Characterization and Treatment of Textile Dyeing Wastewaters, W77-09745 5D

- Water Reuse in a Paper Reprocessing Plant, W77-09757 5D

- Paper Mill Wastewater Treatment by Microstraining, W77-09758 5D

- Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

- Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

- Method and Apparatus for Aerobic Sewage Treatment, W77-09805 5D

- Water Purifying Systems, W77-09808 5F

WASTE WATER TREATMENT

SUBJECT INDEX

- Detoxification of Aqueous Waste Streams Containing Cyanide, W77-09812 5D
- Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D
- Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D
- Liquid Filtering Apparatus, W77-09820 5D
- Gravitational Separator, W77-09821 5D
- Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D
- Continuous Filter Press, W77-09826 5D
- Gear Motor Solves Plant's Noise Problem, W77-09827 8C
- Spray Irrigation-Waste Water Treatment Facility. North Branch Fire District No. 1, West Dover, Vermont, W77-09828 5D
- Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D
- Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D
- Continuous Composting of Organic W W Waste--by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E
- Highly Efficient Aerating System--For An Activated Sludge Effluent Treatment Plant, with Restricted Liquid Circulation in Aerating Tank, W77-09844 5D
- Waste Water Biochemical Purification Control--By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution, W77-09845 5D
- Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment, W77-09847 5D
- Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D
- Low Cost Phosphorus Removal at Reno-Sparks, Nevada, W77-09849 5D
- Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D
- Nitrification in a Chlorinated Activated Sludge Culture, W77-09851 5D
- Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D
- Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D
- Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant, W77-09854 5D
- An Approach to Reduce Water Consumption in Neighborhoods Through Reuse, W77-09855 5D
- Hydrogen Peroxide Subdues Waste Water Plant Problems, W77-09858 5D
- Thurrock Test-Bed for ICI Deep Shaft, W77-09859 5D
- Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D
- Nirmali Seed--A Naturally Occurring Coagulant, W77-09861 5D
- Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D
- Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D
- Pasteur v Curie, W77-09864 5D
- Waste Purification Process, W77-09865 5D
- Oxidation Ditch Gives Low-Cost Secondary Treatment, W77-09866 5D
- Growth of Tulips Treated with Sludge Containing Dewatering Chemicals, W77-09867 5E
- Elemental Composition of Sludge-Fertilized Chrysanthemums, W77-09868 5E
- How Sludge Characteristics Affect Incinerator Design, W77-09869 5E
- Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D
- Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D
- Saffron Walden Opens Its Low Profile Sewage Works, W77-09872 5D
- Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal, W77-09873 5D
- Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D
- Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D
- Radiation Treatment of Sewage Sludge--Experience with an Operating Pilot Plant, W77-09876 5D
- Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D
- Polymer Addition Improves Waste Water Treatment Process, W77-09878 5D
- Character and Dewatering Properties of Sludges from Water Treatment, W77-09881 5D
- Photodynamic Inactivation of Infectious Agents, W77-09883 5D
- Method for the Determination of the Conditionability of Sewage Sludge (Erarbeitung von Methoden zur Ermittlung der Konditionierbarkeit von Klaufschlaemmen), W77-09884 5D
- Mixer Cuts Solids Up and Time Down for Waste Treatment, W77-09885 5D
- New Wastewater Treatment Systems, W77-09886 5D
- A New Rapid Digestion Process for Sewage Sludge Utilization (Ein neues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klaufschlamm-Verwertung), W77-09887 5D
- Study of the Decomposition of Organic Matter by the Respirometric Dilution Method (Untersuchungen ueber das Abbauverhalten organischer Stoffe mit Hilfe der respirometrischen Verduennungsmethode), W77-09888 5D
- Purification Plant Project, W77-09889 5D
- Chemical Treatment of Sewage, W77-09892 5D
- Wastewater Microbiology, W77-09893 5D
- Experiences with the Organic Carbon Analyzer (TOC) by Merz for Routine Monitoring at the BASF Purification Plant (Erfahrungen mit dem TOC-Schnellbestimmer nach Merz in der Routineueberwachung der BASF), W77-09894 5A
- Effluent Treatment Versus Disposal Through Long Sea Outfalls, W77-09895 5E
- Fermentation Technology, W77-09896 5D
- Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A
- Lacey, Olympia, Tumwater, and Thurston County Wastewater Treatment, W77-09898 5D
- Microflotation in Effluent Purification (Mikroflotation in der Abwasseraufbereitung), W77-09899 5D
- The Handling of Nitrogenous Wastes in Rural India, W77-09900 5D

SUBJECT INDEX

WATER POLLUTION

Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D

Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

Aeration: Proper Sizing is Critical, W77-09905 5D

Zeta Potential Measurement, W77-09908 5A

Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A

Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D

The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

South Bend's Industrial Surveillance Waste Water Monitoring Program, W77-09919 5A

Impact of Municipal Water and Sewage Charges on Industry, W77-09921 5G

Cross Canada Report, W77-09923 5G

Clarifier for Underground Use, W77-10081 5D

The Activated Sludge Process, Part 1 - Steady State Behaviour, W77-10094 5D

WATER ANALYSIS

Characterization of Spent Bleaching Liquors. Part 1, Spent Liquors from the Chlorine and Alkali Extraction Stages in the Prebleaching of Pine Kraft Pulp, W77-09731 5A

Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A

Determination of Arsenic Species in Natural Waters, W77-09747 5A

Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A

Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K

Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon, W77-09752 5A

Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K

The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A

Standardization of Methylmercury Analysis, W77-09775 5A

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A

Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B

WATER BIRD

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

WATER BIRDS

A Check List and Notes on the Birds of Sandvick, South West Africa, W77-10089 2L

WATER CHEMISTRY

Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A

WATER CIRCULATION

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B

Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L

Deep Water Renewal and Associated Processes in North Norway, W77-09947 2L

Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

WATER CONSERVATION

How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera), W77-09738 3E

Closed-Cycle Mill Eliminates Pollution While Also Saving Money, W77-09740 3E

WATER COSTS

Impact of Municipal Water and Sewage Charges on Industry, W77-09921 5G

WATER DEMAND

An Approach to Reduce Water Consumption in Neighborhoods Through Reuse, W77-09855 5D

Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A

WATER LEVEL FLUCTUATIONS

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year, W77-10014 2F

WATER LEVELS

Selected Water-Level Records for Western Oklahoma, 1975-1976, W77-09998 7C

Ground-Water Levels in Observation Wells in Oklahoma, 1975, W77-09999 7C

WATER MANAGEMENT

Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D

WATER MANAGEMENT (APPLIED)

Storm Water Management Model: Level I-Comparative Evaluation of Storage-Treatment and Other Management Practices, W77-09824 5D

WATER POLLUTION

Water Transport of Wood (In Canada): The Current Situation, W77-09755 5C

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality, W77-09756 5G

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A

The Case for the Expanded Study of Freshwater Pollution Zoology, W77-10086 5C

Environmental Sciences, W77-10098 6G

SUBJECT INDEX

WATER POLLUTION CONTROL

WATER POLLUTION CONTROL

Relationship of Effluent Limitations to Future Pulp Mill Closures, W77-09727 5D

How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera), W77-09738 3E

Closed-Cycle Mill Eliminates Pollution While Also Saving Money, W77-09740 3E

Method for Detecting Oil in Water, W77-09813 5A

Water Treatment System with Prolonged Aeration, W77-09818 5G

Cross Canada Report, W77-09923 5G

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

WATER POLLUTION EFFECTS

Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C

Effluents of Kraft Mills and Their Toxicity for Hydrobionts (Stochnye vody sul'fat-tsellyuloznykh zavodov i ikh toksichnost' dlya gidrobiontov)), W77-09739 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

WATER POLLUTION SOURCES

Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B

Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B

Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

Effects of Log Handling and Storage on Water Quality, W77-09760 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A

The Fate of Pollutants in Subsurface Environments, W77-09915 5B

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B

Oil Spill Identification System.

W77-10024 5A

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

WATER POLLUTION TREATMENT

Studies on the Reclamation of Stone Lake, Michigan, W77-09605 5G

Closed-Cycle Mill Eliminates Pollution While Also Saving Money, W77-09740 3E

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D

Aerating Apparatus, W77-09819 5G

Liquid Filtering Apparatus, W77-09820 5D

WATER PROPERTIES

A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A

Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L

WATER PURIFICATION

Water System Virus Detection, W77-09636 5A

Treatment of Denim Textile Mill Wastewaters: Neutralization and Color Removal, W77-09724 5D

Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

Water Purifying Systems, W77-09808 5F

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D

Water Treatment System with Prolonged Aeration, W77-09818 5G

Aerating Apparatus, W77-09819 5G

Waste Water Biochemical Purification Control-By Automated Determination of Carbon Dioxide Concentration with Barium Hydroxide Solution, W77-09845 5D

Chemical Treatment of Sewage, W77-09892 5D

Microflotation in Effluent Purification (Mikroflotation in der Abwasseraufbereitung), W77-09899 5D

WATER QUALITY

A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A

Classifying and Monitoring Water Quality by Use of Satellite Imagery, W77-09634 5A

Logging Roads and Protection of Water Quality, W77-09725 5G

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality, W77-09756 5G

Effects of Log Handling and Storage on Water Quality, W77-09760 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

Polymer Addition Improves Waste Water Treatment Process, W77-09878 5D

A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei o senbusshitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosoku-moderu no kaihatsu ni kansuru kenkyu), W77-09911 5B

Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model, W77-09981 5B

The Cockfield Aquifer in Mississippi, W77-09991 7C

Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A

Ground-Water Resources of the Lexington, Kentucky, Area, W77-09996 4B

Water Resources Data for Ohio, Water Year 1975--Volume 1. Ohio River Basin, W77-10000 7C

Water Resources Data for Ohio, Water Year 1975--Volume 2. St. Lawrence River Basin, W77-10001 7C

Water Resources Data For Wyoming, Water Year 1975, W77-10002 7C

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

Water Quality Program of the U.S. Geological Survey, W77-10006 5A

Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A

Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A

SUBJECT INDEX

WATER WELLS

Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L

A Dynamic Water Quality Model for the Neuse Estuary, N.C., W77-10037 5B

An Investigation of the Nearshore Region of Lake Ontario IFYGL. W77-10053 5C

Bay Springs Lake Water-Quality Study, W77-10055 5B

Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

WATER QUALITY CONTROL

A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model, W77-09631 5C

Colorado River Basin Salinity Control Project--Title I, W77-09931 5D

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C

Identification and Analysis of Mid-Atlantic Onshore OCS Impacts, W77-10027 5C

Bottom Withdrawal can Enhance Lake Water Quality, W77-10049 5G

WATER QUALITY INDICES

A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A

WATER RATES

Impact of Municipal Water and Sewage Charges on Industry, W77-09921 5G

WATER RESOURCES

Water Resources Assessment Methodology (WRAM)--Impact Assessment and Alternative Evaluation, W77-09985 6G

Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A

Water Quality Program of the U.S. Geological Survey, W77-10006 5A

Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A

WATER RESOURCES DEVELOPMENT

Arid Lands of Sub-Saharan Africa, W77-09934 6E

WATER REUSE

The Renovation and Re-Use of Wastewater, W77-09686 5D

Relationship of Effluent Limitations to Future Pulp Mill Closures, W77-09727 5D

Fiberboard Mill Recycles Water, W77-09728 5D

Brown (Co.) Recycles De-inking Water on Tissue-Grade Products, W77-09732 5D

Closed-Cycle Mill Eliminates Pollution While Also Saving Money, W77-09740 3E

Water Reuse in a Paper Reprocessing Plant, W77-09757 5D

An Approach to Reduce Water Consumption in Neighborhoods Through Reuse, W77-09855 5D

Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

WATER SAMPLING

Oceanographic Water Sampler, W77-09799 7B

WATER SOURCES

Electrical Water Prospecting, W77-10100 2F

WATER STORAGE

Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

WATER SUPPLY

A Unique Means of Obtaining Sea-Water, W77-09692 8E

How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

The Cockfield Aquifer in Mississippi, W77-09991 7C

Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

WATER TABLE

Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B

WATER TABLES

The Handling of Nitrogenous Wastes in Rural India, W77-09900 5D

WATER TEMPERATURE

Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species, W77-09607 5C

Accommodation of Daphnia pulex to Altered pH Conditions as Measured by Feeding Rate, W77-09678 5C

The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of Serpula Vermicularis L. (Annelida: Polychaeta), W77-09684 5C

Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L

A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L

Temperature Effects on Young Yellow Perch, Perca Flavescens (Mitchill), W77-09773 5C

How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B

WATER TREATMENT

A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

Water Purifying Systems, W77-09808 5F

Water Treatment System with Prolonged Aeration, W77-09818 5G

Aerating Apparatus, W77-09819 5G

Synthetic Aggregates Made from Sewage Plant Sludge, W77-09924 8F

Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics, W77-10087 5F

WATER UTILIZATION

Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A

WATER WELLS

Selected Water-Level Records for Western Oklahoma, 1975-1976, W77-09998 7C

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

SUBJECT INDEX

WATER YIELD

WATER YIELD

Ground-Water Resources of the Lexington, Kentucky, Area, W77-09996 4B

Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

WATERFOWL

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

WATERSHEDS (BASINS)

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

Design and Operation of Rain Spillways and Rain Overflow Catchment (Entwurf und Betrieb von Regenüberläufen (Ru) und Regenüberlaufbecken (RUB)), W77-09822 8B

Small Catchment Flood Modelling, W77-10083 2E

WATERTIGHT

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

WAVE HEIGHTS

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

WAVES (WATER)

Motor Powered by Wave Action, W77-09803 8C

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie, W77-09986 8B

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B

WEATHER MODIFICATION

Weather Modification Effects and Management (A Bibliography with Abstracts), W77-09694 2B

WEATHERING

Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J

WEIRS

North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B

WEISSE MOOR (WEST GERMANY)

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

WEST GERMANY

Intensive Large City Influence on Reed-Banks, (In German), W77-09621 5C

WETLANDS

Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

WHEAT

Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat, W77-09655 3F

Crop Temperature Modification and Yield Potential in a Dwarf Spring Wheat, W77-09939 3F

WHITE SANDS MISSILE RANGE (N MEX)

Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report, W77-10005 4B

WIDTH

Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

WILLAMETTE RIVER DISCHARGES (ORE)

Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A

WIND RIPPLES

Effect of Slope on the Threshold of Motion and Its Application to Orientation of Wind Ripples, W77-09955 2J

WINDS

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

WISCONSIN

Wastewater Treatment by Natural and Artificial Marshes, W77-09606 5D

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B

Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09990 8B

WOOD PRESERVATIVES (PESTICIDES)

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D

WOOD WASTES

Effects of Log Handling and Storage on Water Quality, W77-09760 5C

WORMS

The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of Serpula Vermicularis L. (Annelida: Polychaeta), W77-09684 5C

WYOMING

Water Resources Data For Wyoming, Water Year 1975, W77-10002 7C

YAHARA RIVER (WISC)

Statistical Analysis of the Impact of Ground Water Pumpage on Low-Flow Hydrology, W77-09952 4B

YEASTS

Wastewater Microbiology, W77-09893 5D

YELLOW PERCH

Temperature Effects on Young Yellow Perch, Perca Flavescens (Mitchill), W77-09773 5C

YUKON RIVER WATERSHED (CANADA)

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

ZETA POTENTIAL

Zeta Potential Measurement, W77-09908 5A

ZINC

Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

Catalytic Deoxygenation of Aqueous Solutions by Hydrazine, W77-09766 5B

Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

ZOOPLANKTON

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Characteristics of the Zooplankton of the Lower Reaches of the Iriz and Turgay Rivers, (In Russian), W77-09940 5C

Method of Analyzing Some Experimental Data on Zooplankton, (In Russian), W77-10038 2I

SUBJECT INDEX

ZOOPLANKTON

Biological Effects and Persistence of Methyl
Parathion in Clear Lake, California,
W77-10063

5C

AUTHOR INDEX

- ABBOT, M. A.**
The Temporal Variation of Rainfall Runoff Over the Summer Rainfall Region of South Africa, W77-10091 2B
- ABBOTT, W. V. III**
Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C
- ABDULAPPA, M. K.**
Productivity of *Clarias* *Batrachus* in the Sewage Fertilized Fish Ponds, W77-09922 5C
- ABEL, P. D.**
Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C
- ABERNATHY, A. R.**
Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs, W77-09667 5C
- ABLES, J. H. JR.**
Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B
- ADAMS, F.**
Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G
- ADAMS, O. L.**
Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C
- AKINS, M. B.**
Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS, W77-09659 5B
- ALBERTS, J. J.**
An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C
- ALESTALO, M.**
Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe, W77-09710 2D
- ALETI, A.**
Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B
- ALEXANDER, E. B.**
Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G
- ALEXANDER, M.**
Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G
- ALFORD, A. L.**
Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75, W77-09782 5A
- ALLEN, D. M.**
Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D
- ALLEN, J. L.**
Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C
- ALLEN, S. P.**
Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C
- ALMEIDA, S. A. S.**
Advance Sewer Planning for Rio de Janeiro Coastline, W77-09890 5D
- ALPERT, J. E.**
Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil, W77-09654 5D
- ALVAREZ DE BENITO, G.**
Stabilization of Sand Dunes in the West Sahara, W77-10074 4A
- AMEIN, M.**
A Dynamic Water Quality Model for the Neuse Estuary, N.C., W77-10037 5B
- ANDERSON, M. G.**
A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G
- ANDERSON, R. F.**
Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B
- ANDERSON, R. Y.**
Short Term Sedimentation Response in Lakes in Western United States as Measured by Automated Sampling, W77-09701 2J
- ANDO, S.**
Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D
- ANDREAE, M. O.**
Determination of Arsenic Species in Natural Waters, W77-09747 5A
- ANDREWS, C. W.**
Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C
- ANDREWS, J. F.**
Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D
- ANISIMOV, A. A.**
Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides, W77-10059 4A
- ANISIMOV, M. M.**
Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I
- ANTIPOV, N. I.**
Water Exchange of Juicy Fruits of Trees and Bushes, (In Russian), W77-09611 2D
- ANTONOV, I. S.**
Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I
- APPERSON, C. S.**
Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C
- APPLETON, B.**
Thurrock Test-Bed for ICI Deep Shaft, W77-09859 5D
- ARNDT, B. M.**
Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill, W77-09925 5B
- ASHLEY, C. S.**
Identification of the Virucidal Agent in Waste Water Sludge, W77-09897 5A
- EVERY, J.**
Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K
- AXFORD, R. M.**
Motor Powered by Wave Action, W77-09803 8C
- BAINBRIDGE, G.**
Purification Plant Project, W77-09889 5D
- BAKER, C. E.**
Nitrate and Phosphate Content of Ground and Surface Waters of the White River Drainage, Northwest Nebraska, W77-09743 5B
- BAKER, J. H.**
A Simple Hand Corer for Shallow Water Sampling, W77-09715 7B
- BAKHVALOV, N. S.**
Movement of Snow Avalanches, W77-09716 2C
- BAL, A. S.**
Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D
- BALUJA, G.**
Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

AUTHOR INDEX

BANNER, F. T.

BANNER, F. T.
The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel, W77-09944 2L

BARBER, S. A.
Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F

BARDING, P.
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

BARTLETT, R. J.
Simulation of Plant Growth by Humic Substances, W77-09963 2I

BATTALORA, H.
Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B

BAYLEY, S. E.
Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

BEARD, W. E.
Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B

BECK, M. B.
The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

BEHREND, D. O.
Traveling Irrigation Sprinkler, W77-09811 3F

BEHRENS, E. W.
Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75, W77-09982 2L

BELLIS, V.
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L

BENDER, M. E.
The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C

BENJAMIN, L.
Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics, W77-10087 5F

BENNETT, A. C.
Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions, W77-09979 2G

BENNETT, B. D.
Continuous On-Line Monitoring of Total Organic Carbon, W77-09635 5A

BENNETT, F. W.
Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

BENSON, H. A.
Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation, W77-10019 8B

BERNDT, R. D.
The Nature of Changes in Bulk Density with Water Contents in Cracking Clay, W77-09937 2G

BERRY, C. U.
A Check List and Notes on the Birds of Sandvis, South West Africa, W77-10089 2L

BERRY, H. H.
A Check List and Notes on the Birds of Sandvis, South West Africa, W77-10089 2L

BILLS, T. D.
Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon, W77-09764 5C

BLANCHARD, M. B.
An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G

BLASKO, D. P.
Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

BLEDSE, B. E.
Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G

BLISS, F. R.
Paper Mill Wastewater Treatment by Microstraining, W77-09758 5D

BOATRIGHT, D. T.
Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D

BODE, C. A.
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

BODZEK, M.
Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwróconej osmozy i ultrafiltracji do oczyszczania ścieków z przemysłu celulozowo-papierniczego), W77-09733 5D

BOGARDUS, R. B.
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C

Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C

BOKIL, S. D.
Nirmali Seed--A Naturally Occurring Coagulant, W77-09861 5D

BONDIETTI, E. A.
Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers, W77-09967 2G

BOOTH, W. E.
A Methodology for Comparative Evaluation of Water Quality Indices, W77-09632 5A

BOTTIN, R. R. JR.
Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09989 8B

Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation, W77-09990 8B

BOWARD, J. F. JR.
Aerating Apparatus, W77-09819 5G

BOWEN, S. P.
Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D

BOWMAKER, A. P.
The Darwendale Reservoir as a Fishery, W77-10096 2H

The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba, W77-09614 5C

BOWMAN, B. T.
Influence of Cation Content on the Biological Activity of Fensulfothion in Plainfield Sand, W77-09639 2G

BOYT, F. L.
Removal of Nutrients from Treated Municipal Waste Water by Wetland Vegetation, W77-09916 5D

BRANDON, J. R.
Inactivation by Ionizing Radiation of *Salmonella* Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D

BRUN, C. V. JR.
A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

- BRAXTON, C.**
Potential Environmental Consequences of Tertiary Oil Recovery,
W77-10023 5C
- BRINKLEY, F. S.**
Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers,
W77-09967 2G
- BROOKS, R. M.**
Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie,
W77-09986 8B
- BROWN, M.**
Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance,
W77-09945 5A
- BROWN, R. J.**
Weather Modification Effects and Management (A Bibliography with Abstracts),
W77-09694 2B
- BRUNSKILL, G. J.**
Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada,
W77-09617 5C
- BRUTON, M. N.**
Lake Sibaya - A Land-Locked Estuary,
W77-10099 2H
- BUECHS, L.**
Experiences with the Organic Carbon Analyzer (TOC) by Merz for Routine Monitoring at the BASF Purification Plant (Erfahrungen mit dem TOC-Schnellbestimmer nach Merz in der Routineüberwachung der BASF),
W77-09894 5A
- BULATOVA, T. A.**
Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides,
W77-10059 4A
- BURGE, W. D.**
Inactivation by Ionizing Radiation of Salmonella Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge,
W77-09880 5D
- BURGHARDT, W.**
Influences of Some Peat Soil Features on the Capillary Water Supply, (In German),
W77-09626 2G
- BURNETT, W. C.**
Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace,
W77-09951 2J
- BURNEY, J. R.**
Small Catchment Flood Modelling,
W77-10083 2E
- BURROWS, W. D.**
Standardization of Methylmercury Analysis,
W77-09775 5A
- BURSZTYNSKY, T. A.**
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods,
W77-09759 5D
- BURT, T. P.**
A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope,
W77-09712 2G
- BURTON, T. M.**
The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire,
W77-09807 4C
- BUTLER, H. L.**
Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study,
W77-10048 8B
- BUXTON, K. S.**
Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species,
W77-09784 5C
- CALDER, I. R.**
A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales,
W77-09711 2D
- CAMMEN, L. M.**
Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil,
W77-10035 2L
- CAMPBELL, N. E. R.**
Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species,
W77-09607 5C
- CAMPBELL, P.**
Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada,
W77-09617 5C
- CANALE, R. P.**
A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model,
W77-09631 5C
- CANTER, L. W.**
Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation,
W77-09985 6G
- CARTER, V.**
The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing,
W77-10007 2H
- CARUBIA, P. C.**
A Methodology for Comparative Evaluation of Water Quality Indices,
W77-09632 5A
- CARVER, R. D.**
Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation,
W77-09984 8B
- CASTLE, W.**
Biological Effects and Persistence of Methyl Parathion in Clear Lake, California,
W77-10063 5C
- CAVENDER, J. V. JR.**
Detoxification of Aqueous Waste Streams Containing Cyanide,
W77-09812 5D
- CHAMBERS, J. E.**
Liquid Filtering Apparatus,
W77-09820 5D
- CHAN, Y. K.**
Temperature Effects on the Denitrification Products by Two Aquatic Pseudomonas Species,
W77-09607 5C
- CHASTEEN, N. D.**
Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry,
W77-09750 2K
- CHATHAM, C. E.**
Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design,
W77-10016 8B
- CHAUDHURI, M.**
Nirmali Seed-A Naturally Occurring Coagulant,
W77-09861 5D
- CHEREMISINOFF, P. N.**
Land Application of Municipal Sludge,
W77-09882 5E
- CHIAN, E. S. K.**
Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography,
W77-09746 5A
- CHIAN, E. S. K.**
Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge,
W77-09850 5D
- CHILDREY, M. R.**
Impact of Economic Risks on Box Culvert Designs-An Application to 22 Virginia Sites,
W77-10067 8B
- CHIU, S. Y.**
Loading Functions for Assessment of Water Pollution from Nonpoint Sources,
W77-09726 5B
- CHRISTOPHER, D. H.**
Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents,
W77-09770 5B
- CHUNNETT, E. P.**
Tunnelling Work for the Ruacana Scheme,
W77-09688 8A
- CHURCHILL, R. J.**
Polymer Addition Improves Waste Water Treatment Process,
W77-09878 5D
- CICCONE, V. J.**
A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I,
W77-09774 5G
- CILLIE, G. G.**
The Renovation and Re-Use of Wastewater,
W77-09686 5D

AUTHOR INDEX

CLARK, L. K.

- CLARK, L. K.
Demonstrating the Feasibility of Vacuum and Pressure Sewers,
W77-09834 5D

- CLARK, M. J. R.
Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish,
W77-09792 5C

- CLARK, W. J.
Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations,
W77-09628 5C

- CLEMENTZ, D. M.
Adsorption of Dodecylbenzene Sulfonate on NA(+)-Montmorillonite: Effect of Salt Impurities,
W77-09651 2G

- CLUTE, P. R.
Macrophyte-Sediment Relationships in Chautauqua Lake,
W77-09612 5C

- COLBERT, B. K.
Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation,
W77-09985 6G

- COLLINS, D. L.
Computation of Records of Streamflow at Control Structures,
W77-10003 2E

- COLWELL, R. R.
Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria,
W77-09772 5C

- CONSTANTINE, K. J.
Sedimentation Rates in a Coastal Marsh Determined from Historical Records,
W77-09713 2J

- COOLEY, R. L.
A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties,
W77-10008 2F

- COPELAND, B. J.
Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil,
W77-10035 2L

- CORBETTA, D.
How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera),
W77-09738 3E

- CORNELL, C. F.
Closed-Cycle Mill Eliminates Pollution While Also Saving Money,
W77-09740 3E

- CORNWELL, D. A.
Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment,
W77-09847 5D

- COSULICH, W. F.
Co-Burning of Sludge and Refuse with Waste Heat Recovery,
W77-09857 5E

- COUGHLAN, K. J.
The Nature of Changes in Bulk Density with Water Contents in Cracking Clay,
W77-09937 2G

- COUGHLIN, R. L.
Relationship of Effluent Limitations to Future Pulp Mill Closures,
W77-09727 5D

- COUSENS, D. W.
Small Catchment Flood Modelling,
W77-10083 2E

- COWEN, W. F.
Algal Nutrient Availability and Limitation in Lake Ontario During IFGYL. Part 1, Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters,
W77-10052 5C

- CRADDOCK, D. R.
Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food,
W77-09683 5C

- CRAM, P.
The Effect of Parasitism on the Toxicity of Cadmium to the Three-spined Stickleback, *Gasterosteus aculeatus* L.,
W77-09666 5C

- CRANDALL, C. J.
Review and Evaluation of Aeration Tank Design Parameters,
W77-09870 5D

- CRANE, D. R.
Classifying and Monitoring Water Quality by Use of Satellite Imagery,
W77-09634 5A

- CRANE, J. D.
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods,
W77-09759 5D

- CROWLEY, P. H.
Filtering Rate Inhibition of *Daphnia pulex* in Wintergreen Lake Water,
W77-09910 5C

- CRUZ, P. MIRNA
Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish),
W77-10066 2L

- CRUZ, R. R.
Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report,
W77-10005 4B

- CUDAHY, J. J.
How Sludge Characteristics Affect Incinerator Design,
W77-09869 5E

- CULBERSON, J. S.
The Functional and Aesthetic Uses of Two Cache Valley, Utah, Canals,
W77-09796 6B

- CUMBIE, P. M.
Mercury Accumulation by Largemouth Bass (*Micropterus salmoides*) in Recently Impounded Reservoirs,
W77-09667 5C

- CURTAIN, D.
Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter,
W77-09971 2G

- CUSHMAN, M. K.
Sedimentation Rates in a Coastal Marsh Determined from Historical Records,
W77-09713 2J

- DAKES, G.
Land Application of Municipal Sludge,
W77-09882 5E

- DALAL, R. C.
Evaluation of the Parameters of Soil Phosphorus Availability Factors in Predicting Yield Response and Phosphorus Uptake,
W77-09646 2G

- DAS, H. A.
The Determination of Molybdenum and Tungsten in Sea and Surface Water,
W77-09754 5A

- DAVIDSON, D. D.
Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation,
W77-09984 8B

- DE BOODT, M.
An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch),
W77-09613 2G

- DE NAIDE, O. V.
Effect of Organic Excretion by Benthic Annelids on the Productivity of Phytoplankton,
W77-09660 5C

- DEAN, J. D.
Temporally and Areally Distributed Rainfall,
W77-09696 2B

- DEKII, S. A.
Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioactive Indicator (On the Example of Lake Baikal), (In Russian),
W77-09735 5B

- DENISOV, YU. M.
Mathematical Description of Some Physical Snow Cover Characteristics,
W77-09717 2C

- DENMAN, K. L.
Short Term Variability in Vertical Chlorophyll Structure,
W77-09702 2L

- DENOVE, M. B.
How Sludge Characteristics Affect Incinerator Design,
W77-09869 5E

- DEPINTO, J. V.
Studies on the Reclamation of Stone Lake, Michigan,
W77-09605 5G

- DESCY, J. P.
A Practical Apparatus for Quantitative Sampling of Epilithic Periphyton, (In French),
W77-09623 7B

- DESHPANDE, W. M.
Chemical Treatment of Sewage,
W77-09892 5D

- DEWALLE, D. R.**
Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil, W77-09654 5D
- DEWALLE, F. B.**
Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A
Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D
- DEWATH, E. J.**
Acoustical Wave Flowmeter, W77-09809 7B
- DHABADGAONKAR, S. M.**
Chemical Treatment of Sewage, W77-09892 5D
- DIGIANO, F. A.**
Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D
- DIXON, J. B.**
Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G
- DOBIAS, B.**
Microflotation in Effluent Purification (Mikroflotation in der Abwasseraufbereitung), W77-09899 5D
- DODSON, J.**
Calcium Carbonate Formation by Enteromorpha Nana Algae in a Hypersaline Volcanic Crater Lake, W77-09787 2H
- DOMMERHOLT, A.**
Brink Depth Method in Rectangular Channel, W77-09695 8B
- DORAN, J. W.**
Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G
- DORTCH, M. S.**
Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation, W77-10044 8B
Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B
- DRORI, M.**
Rotary Sprinkler Particularly for Use with Low-Energy Water Jets, W77-09802 3F
Self-Regulating Sprinkler, W77-09801 3F
- DROST-HANSEN, W.**
A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B
- DUCKERT, W.**
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C
- DUICH, J. M.**
Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass, W77-09978 3C
- DUKE, T.**
Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A
- DURHAM, D. L.**
Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study, W77-10048 8B
Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B
- DURKIN, P. R.**
Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B
- DYER, T. G.**
The Temporal Variation of Rainfall Runoff Over the Summer Rainfall Region of South Africa, W77-10091 2B
- EASTMAN, J.**
Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B
- EBLEN, J. E.**
Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D
- EDIGER, R. D.**
Atomic Absorption in Water and Waste Water Analysis, W77-09909 5A
- EDWARDS, R. H.**
Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, Paralichthys Lethostigma, and the Sea Catfish, Arius Felis, W77-09780 5C
- EDWARDS, R. W.**
The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B
- EGLIT, M. E.**
Movement of Snow Avalanches, W77-09716 2C
- EICHENBERGER, E.**
Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C
Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C
- EKAMA, G. A.**
The Activated Sludge Process, Part 1 - Steady State Behaviour, W77-10094 5D
- EL-KANDELGY, S. M.**
Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C
- EL-SWAIFY, S. A.**
Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying, W77-09975 2G
- ELLIOTT, S.**
Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C
- ELSTON, R.**
Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C
- ENFIELD, C. G.**
Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G
- ENKIRI, N. K.**
Inactivation by Ionizing Radiation of Salmonella Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge, W77-09880 5D
- ERDMAN, F. S.**
How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C
- ERDMAN, J. B.**
Determining Photosynthetic Productivity in Streams, W77-10080 5C
- ESCARZAGA, R.**
Ammonia Volatilization from Surface Applications of Ammonium Compounds on Calcareous Soils: V. Soil Water Content and Method of Nitrogen Application, W77-09960 2G
- FAN, L. T.**
Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D
- FARO, R. C.**
Some Effects of Lime Addition on High Solids, Completely Mixed, Activated Sludge Waste Water Treatment, W77-09601 5D
- FAST, A.**
A Guide to Aeration/Circulation Techniques for Lake Management, W77-09603 5G

AUTHOR INDEX

FAST, A.

FAUST, R. J.
Ground-Water Resources of the Lexington,
Kentucky, Area,
W77-09996 4B

FAVA, J. A.
Immediate Behavioral Reactions of Blacknose
Dace, *Rhinichthys atratulus*, to Domestic
Sewage and its Toxic Constituents,
W77-09669 5C

FENG, C.-J.
Optimal Operation of Flood Control Systems,
(Final Report; V.II),
W77-09927 4A

FENN, L. B.
Ammonia Volatilization from Surface Applica-
tions of Ammonium Compounds on Calcareous
Soils: V. Soil Water Content and Method of
Nitrogen Application,
W77-09960 2G

The Influence of Cation Exchange Capacity
and Depth of Incorporation on Ammonia
Volatilization from Ammonium Compounds
Applied to Calcareous Soils,
W77-09961 2G

FETTER, C. W.
Wastewater Treatment by Natural and Artifi-
cial Marshes,
W77-09606 5D

FETTER, C. W. JR.
Statistical Analysis of the Impact of Ground
Water Pumpage on Low-Flow Hydrology,
W77-09952 4B

FIELD, R.
Urban Runoff Pollution Control-Technology
Overview,
W77-09823 5D

FIELDING, A. H.
The Effect of Copper on Competition Between
Marine Algae,
W77-10051 5C

FINSTEIN, M. S.
Nitrification in a Chlorinated Activated Sludge
Culture,
W77-09851 5D

FISCHER, R. A.
Crop Temperature Modification and Yield
Potential in a Dwarf Spring Wheat,
W77-09939 3F

FISH, F.
Butoxyethanol Ester of 2,4-D for Control of
Eurasian Water Milfoil,
W77-10057 4A

FISHER, R. G.
Chellaston Trunk Foul Sewer. Some Interesting
Aspects of the Scheme,
W77-09837 5D

FLESSA, K. W.
Sedimentation Rates in a Coastal Marsh Deter-
mined from Historical Records,
W77-09713 2J

FLETCHER, B. P.
Flow Conditions at Pumping Stations, Cairo, Il-
linois; Hydraulic Model Investigation,
W77-10043 8B

FLETCHER, K.
Interactions Between Zinc and Suspended
Sediments in the Fraser River Estuary, British
Columbia,
W77-09949 5B

FLOOD, F.
Biological Fluidized-Bed Treatment for BOD
and Nitrogen Removal,
W77-09873 5D

FLUEHLER, H.
Determination of Hydraulic Parameters to Esti-
mate Water Movement and Water Storage in
Undisturbed Soil: Comparison of Field and
Laboratory Methods, (In German),
W77-09624 2G

FONTANE, D. G.
Dickey-Lincoln School Lakes Hydrothermal
Model Study; Hydraulic Laboratory Investiga-
tion,
W77-09987 8B

FOSTER, B. B.
Computer Simulation of Phosphorus Movement
Through Soils,
W77-09970 5B

FOSTER, J. E.
Lake Dardanelle, Arkansas River; Hydraulic
Model Investigation,
W77-09988 8B

FOURIE, H. O.
Dehydration of Marine Zoological Material -
Volatility of Metabolised Selenium at 105-120C,
W77-10095 5A

FOX, R. L.
The Slow Reaction which Continues After
Phosphate Adsorption: Kinetics and Equilibri-
um in Some Tropical Soils,
W77-09980 2G

FRANCO, J. J.
Entrance to Upstream Approach Canal,
Gainesville Lock, Tombigbee River, Mississip-
pi and Alabama; Hydraulic Model Investiga-
tion,
W77-10047 8B

Lake Dardanelle, Arkansas River; Hydraulic
Model Investigation,
W77-09988 8B

FRASER, A. S.
Water System Virus Detection,
W77-09636 5A

FRASER, H. R.
Fiberboard Mill Recycles Water.
W77-09728 5D

FRITTON, D. D.
Soil Temperatures and Heat Loss for a Hot
Pipe Network Buried in Irrigated Soil,
W77-09654 5D

FRONEBERGER, C. R.
Treatment of Denim Textile Mill Wastewaters:
Neutralization and Color Removal,
W77-09724 5D

FROSTICK, L. E.
The Origin of Horizontal Laminae in
Ephemeral Stream Channel-Fill,
W77-09950 2J

FRYKBERG, W. R.
Limnological Investigation of the Muskegon
County, Michigan, Wastewater Storage
Lagoons. Phase I,
W77-10061 5C

FUCHS, M.
Effect of Increasing Foliage Reflectance on the
CO₂ Uptake and Transpiration Resistance of a
Grain Sorghum Crop,
W77-09942 2D

FUHS, G. W.
Restoration of Lower St. Regis Lake (Franklin
County, New York),
W77-10054 5C

FURH, E. G.
Methodology to Evaluate Alternative Coastal
Zone Management Policies: Application in the
Texas Coastal Zone, Special Report III: A
Methodology for Investigating Fresh Water In-
flow Requirements of a Texas Estuary, Vol I,
W77-10022 2L

GAGNON, G. A.
Review and Evaluation of Aeration Tank
Design Parameters,
W77-09870 5D

GAMES, L. M.
Carbon Isotopic Study of the Fate of Landfill
Leachate in Groundwater,
W77-09917 5B

GAMMON, P.
The Great Dismal Swamp: Management of a
Hydrologic Resource with the Aid of Remote
Sensing,
W77-10007 2H

GANGSTAD, E. O.
Butoxyethanol Ester of 2,4-D for Control of
Eurasian Water Milfoil,
W77-10057 4A

GANNON, J. E.
Biological, Chemical and Physical Relation-
ships in the Straits of Mackinac,
W77-10058 5C

GARCIA, A. W.
Effect of Source Orientation and Location in
the Peru-Chile Trench on Tsunami Amplitude
Along the Pacific Coast of the Continental
United States,
W77-09983 2L

GARCIA-MIRAGAYMA, J.
Influence of Ionic Strength and Inorganic Com-
plex Formation on the Sorption of Trace
Amounts of CD by Montmorillonite,
W77-09658 5B

GARG, S. C.
Evaluation of Utility Equipment for Harbor Oil
Spill Removal/Recovery Systems,
W77-10031 5G

GARRETT, M. K.
The Great Dismal Swamp: Management of a
Hydrologic Resource with the Aid of Remote
Sensing,
W77-10007 2H

GASCHO, G. J.
Sulfur-Coated Fertilizers for Sugarcane: I.
Plant Response to Sulfur-Coated Urea,
W77-09640 3F

AUTHOR INDEX

HALL, W.

- Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KCl, W77-09641 3F
- GAUDY, A. F. JR.
Chemically Assisted Biological Oxidation of Wastes and Excess Sludge, W77-09871 5D
- GEISSER, D.
An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island, W77-09637 2F
- GELDENHUYS, J. N.
Waterfowl (Anatidae) on Irrigation Lakes in the Orange Free State, W77-10097 2H
- GEORGE, D. G.
The Effect of Wind on the Distribution of Chlorophyll A and Crustacean Plankton in a Shallow Eutrophic Reservoir, W77-09679 5B
- GERBA, C. P.
Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D
Photodynamic Inactivation of Infectious Agents, W77-09883 5D
- GERMANN, P.
Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G
- GHONSIKAR, C. P.
Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G
- GIBSON, C. I.
Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A
- GIFFORD, G. F.
Vegetation Manipulation--A Case Study of the Pinyon-Juniper Type, W77-09959 4C
- GILMAN, H. D.
Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D
- GLANCY, P. A.
Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A
- GOEMAAT, R. L.
Ground-Water Levels in Observation Wells in Oklahoma, 1975, W77-09999 7C
Selected Water-Level Records for Western Oklahoma, 1975-1976, W77-09998 7C
- GOLDSMID, J. M.
Observations on the Intestinal Protozoa Infecting Man in Rhodesia, W77-09691 5F
- Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia, W77-10076 5G
- GOMBERG, D. N.
Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace, W77-09951 2J
- GONS, H. J.
An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C
- GONTHIER, J. B.
Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A
- GOODNIGHT, C. J.
Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase I, W77-10061 5C
- GORDON, H. H.
Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification, W77-10026 2L
- GOSSLING, E.
Matting for the Prevention of Hydraulic Erosion, W77-09798 4D
- GRABER, B. W.
Hydro-Electric Development of the Tugela River, W77-10073 8C
- GRACE, J. L. JR.
Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation, W77-10043 8B
Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B
- GRAESER, H. J.
Computer Application in Water and Waste Water Management: A Panel Discussion, W77-09903 5D
- GRAHAM, B. W.
Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C
- GRAVES, A. P.
A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G
- GRAY, J. S.
The Effects of Salinity, Temperature, and Mercury on Mortality of the Trochophore Larvae of Serpula Vermicularis L. (Annelida: Polychaeta), W77-09684 5C
- GRIEVE, D.
Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B
- GRIFFITHS, D. K.
The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L
- GRILL, E. V.
The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L
- GROTNES, P. E.
The Consequences of Impoundment on an Arctic Char Lake System. An Analysis by Simulation Modelling, W77-09616 5B
- GRUGER, E. H. JR.
Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C
- GUENZI, W. D.
Piclofom Degradation in Soils as Influenced by Soil Water Content and Temperature, W77-09644 5B
- GUINCHARD, C.
Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A
- GUPTA, U. C.
Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat, W77-09655 3F
- GUTSELL, J. S.
Influence of Certain Water Conditions, Especially Dissolved Gasses, on Trout, W77-09790 5C
- HADJIOANNOU, S. I.
Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K
- HADJIOANNOU, T. P.
Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer, W77-09753 2K
- HAGHIRI, F.
Release of Cadmium from Clays and Plant Uptake of Cadmium from Soil as Affected by Potassium and Calcium Amendments, W77-09962 2G
- HAIGH, H.
Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D
- HALL, W.
Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

AUTHOR INDEX

HALLSWORTH, E. G.

HALLSWORTH, E. G.

Evaluation of the Parameters of Soil Phosphorus Availability Factors in Predicting Yield Response and Phosphorus Uptake, W77-09646 2G

HAMILTON, R. D.

Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C

HANAI, T.

Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A

HANDRY, R.

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A

HANSEN, R. E.

Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

HANSEN, W. J.

Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation, W77-09985 6G

HANSON, G.

Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K

HANSON, J. P.

Brown (Co.) Recycles De-inking Water on Tissue-Grade Products, W77-09732 5D

HARDELL, H. L.

Characterization of Spent Bleaching Liquors. Part 1, Spent Liquors from the Chlorine and Alkali Extraction Stages in the Prebleaching of Pine Kraft Pulp, W77-09731 5A

HARLIN, C. C.

Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils, W77-09968 2G

HARRIS, C. R.

Influence of Cation Content on the Biological Activity of Fensulfothion in Plainfield Sand, W77-09639 2G

HARRIS, D. D.

Water Resources of the Umatilla Indian Reservation, Oregon, W77-10011 4A

HART, E. D.

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

HARTER, R. D.

Computer Simulation of Phosphorus Movement Through Soils, W77-09970 5B

HASHIMOTO, H.

A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitai o senbushitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosokumoderu no kaihatu ni kansuru kenkyu), W77-09911 5B

HASSETT, J. J.

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

HATCHER, P. G.

Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A

HATTINGH, J.

The Effect of Tricain Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood, W77-09665 5C

HAYES, E. R.

Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A

HAYES, J. M.

Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater, W77-09917 5B

HEANEY, J. P.

Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D

Storm Water Management Model: Level I-Comparative Evaluation of Storage-Treatment and Other Management Practices, W77-09824 5D

HEDMAN, E. R.

Variation of Width and Discharge for Natural High-Gradient Stream Channels, W77-10009 2E

HELMS, D. R.

Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

HENDERSON, R. W.

Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

HENRY, J. E.

Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield, W77-09969 3F

HERBERT, T. L.

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

HERRANDEZ, L. M.

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

HERRICKS, E. E.

Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A

HETLING, L. J.

Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C

HEYDORN, A. E.

Wisselwerking tussen land en see, of, die ekologie van die kuswaters van Natal (The Interaction between Land and Sea, or, the Ecology of the Coastal Waters of Natal), W77-10072 2L

HICKEY, R.

Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal, W77-09873 5D

HINES, A. L.

Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

HINTON, D. E.

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

HOBBS, M. F.

Photodynamic Inactivation of Infectious Agents, W77-09883 5D

HOBBS, P. V.

Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements, W77-09720 2B

HOGAN, C.

Water Reuse in a Paper Reprocessing Plant, W77-09757 5D

HOKAO, Z.

Jet-Flame Saves Sludge Disposal Cost with Deodorizing Effect, W77-09737 5E

HOLLEY, E. R.

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

HONS, F. M.

Potassium Sources and Availability on a Deep, Sandy Soil of East Texas, W77-09972 2G

HORNING, R. H.

Characterization and Treatment of Textile Dyeing Wastewaters, W77-09745 5D

HORNUNG, H.

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

HOUSTON, J. R.

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project, W77-10040 8B

Los Angeles Harbor Numerical Analysis of Harbor Oscillations, W77-10042 8B

HOWARD, A. D.

Effect of Slope on the Threshold of Motion and Its Application to Orientation of Wind Ripples, W77-09955 2J

AUTHOR INDEX

KISSEL, D. E.

- HOWARD, P. H.**
Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B
- HUBER, W. C.**
Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D
- HUFF, B. L.**
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C
- HUME, D. N.**
Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A
- HUMMEL, F. JR.**
Remote Control for Large-Area Sprinkler Systems, W77-09814 3F
- HUMPHREY, A. E.**
Fermentation Technology, W77-09896 5D
- HUNN, J. B.**
Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol, W77-09662 5C
- HUYER, A.**
Seasonal Variation in Temperature, Salinity, and Density Over the Continental Shelf Off Oregon, W77-09703 2L
- IDSO, S. B.**
An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G
- IGNATIADIS, L.**
Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C
- JACKSON, D. R.**
Extraction of Soil Water Using Cellulose-Acetate Hollow Fibers, W77-09967 2G
- JACKSON, R. D.**
An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content, W77-09957 2G
- JACKSON, S.**
Environmental Sciences. W77-10098 6G
- JACOBS, A.**
Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D
- JACQUEMAIN, R.**
Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A
- JAMES, I. D.**
A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L
- JANK, B. E.**
Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D
- JENSEN, A.**
Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C
- JERIS, J. S.**
Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal, W77-09873 5D
- JETER, J. M.**
South Bend's Industrial Surveillance Waste Water Monitoring Program, W77-09919 5A
- JOHNSON, H. D.**
Shallow Marine Sand Bar Sequences: An Example from the Late Precambrian of North Norway, W77-09699 2J
- JOHNSON, H. E.**
The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C
- JONES, R. H.**
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D
- JUBB, R. A.**
Further Important Features of the Fish Fauna of the Clanwilliam Olifants River System, Southwestern Cape, W77-10090 2E
- KACHELIA, K. K.**
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
- KAESLER, R. L.**
Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A
- KANEMASU, E. T.**
Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D
- KARAU, J.**
Water Transport of Wood (In Canada): The Current Situation, W77-09755 5C
- KASHKOVSKI, V. V.**
Urcelarids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian), W77-09936 2H
- KATZER, T. L.**
Water-Resources Appraisal of the Carson River Basin, Western Nevada, W77-09992 4A
- KEISTER, L. E.**
Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A
- KELLY, H. G.**
Design Proposals for Submersible Sewage Lift Stations, W77-09839 8C
- KHAN, A. N.**
Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D
- KILHAM, P.**
Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C
- KILHAM, S. S.**
Melosira Granulata (Ehr.) Ralfs: Morphology and Ecology of a Cosmopolitan Freshwater Diatom, W77-09619 5C
- KIM, J. H.**
Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A
- KIMBALL, G. L.**
Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C
- KIMBALL, K. T.**
A Simple Hand Corer for Shallow Water Sampling, W77-09715 7B
- KIMBEL, A. L.**
Lacey, Olympia, Tumwater, and Thurston County Wastewater Treatment, W77-09898 5D
- KING, E. B.**
Remote Control for Large-Area Sprinkler Systems, W77-09814 3F
- KINOSHITA, M.**
Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D
- KIRKHAM, M. B.**
Elemental Composition of Sludge-Fertilized Chrysanthemums, W77-09868 5E
Growth of Tulips Treated with Sludge Containing Dewatering Chemicals, W77-09867 5E
- KISSEL, D. E.**
The Influence of Cation Exchange Capacity and Depth of Incorporation on Ammonia

AUTHOR INDEX

KISSEL, D. E.

Volatilization from Ammonium Compounds Applied to Calcareous Soils, W77-09961 2G

KITAGAWA, N.

Studies on the Bottom Fauna of Four Lakes in Eastern Hokkaido (Lakes Kussharo-Ko, Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In Japanese), W77-10028 5C

KLIER, K.

Ice Nucleation by Micas, W77-09956 2B

KNEER, F. X.

Continuous Composting of Organic W W Waste—by Automatic Control of Fermentation Temperature and Humidity of Product and Control of Carbon Dioxide or Oxygen in Waste Gases, W77-09831 5E

KNOTT, R. K.

Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year, W77-09997 7C

KNOWLES, R.

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B

KOEPPE, D. E.

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

KOLAJA, G. T.

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

KOMAR, P. D.

The Causes of Erosion to Siletz Spit, Oregon, W77-10039 2L

KOMINEK, O.

Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego), W77-09733 5D

KONIKOW, L. F.

Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado, W77-09994 5B

KONSTANDT, H. G.

A New Rapid Digestion Process for Sewage Sludge Utilization (Ein neues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klärschlamm-Verwertung), W77-09887 5D

KOS, P.

Gravity Thickening of Water-Treatment-Plant Sludges, W77-09912 5D

KOWALSAKA, E.

Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania sciekow z przemyslu celulozowo-papierniczego), W77-09733 5D

KOZIK, YE. M.

Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C

KRAJENHOFF, D. A.

Brink Depth Method in Rectangular Channel, W77-09695 8B

KRENKEL, P. A.

Standardization of Methylmercury Analysis, W77-09775 5A

KRING, R. L.

Accommodation of Daphnia pulex to Altered pH Conditions as Measured by Feeding Rate, W77-09678 5C

KRISHNAMOORTHY, K. P.

Productivity of Clarias Batrachus in the Sewage Fertilized Fish Ponds, W77-09922 5C

KRUSE, F. V.

Traveling Irrigation Sprinkler, W77-09811 3F

KUL'GA, A. L.

Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I

KULIKOVSKIY, A. G.

Movement of Snow Avalanches, W77-09716 2C

KULLENBERG, G.

Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L

KUO, M. C.

Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D

KUO, M. S.

Precipitation Trend and Storm Analysis in Colorado, W77-09685 2C

KUO, P. P. K.

Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography, W77-09746 5A

KURKIN, V. N.

Movement of Snow Avalanches, W77-09716 2C

KURTZ, L. T.

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation, W77-09643 2G

KUSHNER, D. J.

Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B

KUZ'MYCHOV, A. I.

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian), W77-09622 2I

LACAZE, J. C.

Effect of Organic Excretion by Benthic Annelids on the Productivity of Phytoplankton, W77-09660 5C

LADEISHCHIKOVA, E. N.

Method of Analyzing Some Experimental Data on Zooplankton, (In Russian), W77-10038 2I

LAFLEUR, K. S.

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

LAI, C.

Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics, W77-09993 2E

LAI, R. J.

Evaporation from a Warm, Wavy Surface: A Laboratory Study, W77-09954 2D

LAMBERT, W. P.

Methodology to Evaluate Alternative Coastal Zone Management Policies: Application in the Texas Coastal Zone, Special Report III: A Methodology for Investigating Fresh Water Inflow Requirements of a Texas Estuary, Vol I, W77-10022 2L

LANDE, S. A.

Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B

LAW, P.

Water Reuse in a Paper Reprocessing Plant, W77-09757 5D

LAWRENCE, C. H.

Rapid Sand Filtration for Best Practical Treatment of Domestic Waste Water Stabilization Pond Effluent, W77-09853 5D

LE ROUX, P. J.

Stabilization of Sand Dunes in the West Sahara, W77-10074 4A

LEE, C. R.

Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D

LEE, G. F.

Algal Nutrient Availability and Limitation in Lake Ontario During IFGYL. Part I, Available Phosphorus in Urban Runoff and Lake Ontario Tributary Waters, W77-10052 5C

LEE, Y. S.

Simulation of Plant Growth by Humic Substances, W77-09963 2I

LEMYK, B.

Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

Lennon, J. S.

Photodynamic Inactivation of Infectious Agents, W77-09883 5D

- LESCHBER, R.**
Method for the Determination of the Conditionability of Sewage Sludge (Erarbeitung von Methoden zur Ermittlung der Konditionierbarkeit von Klärschlämmen),
W77-09884 5D
- LESSEL, T.**
Radiation Treatment of Sewage Sludge—Experience with an Operating Pilot Plant,
W77-09876 5D
- LESSEM, A. S.**
Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model,
W77-09981 5B
- LETEY, J.**
Degradation of a Nonionic Surfactant in Soils and Peat,
W77-09638 5B
- LEUENBERGER, J.**
Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German),
W77-09624 2G
- LEVEY, R. A.**
Macrophyte-Sediment Relationships in Chautaugus Lake,
W77-09612 5C
- LEVINA, E. V.**
Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian),
W77-09938 2I
- LEWIS, R. J.**
Chemical Distribution and Gaseous Evolution of Arsenic-74 Added to Soils as DSMA-(74)AS,
W77-09659 5B
- LIGGETT, R. S.**
South Bend's Industrial Surveillance Waste Water Monitoring Program,
W77-09919 5A
- LIGHTSEY, G. R.**
Concurrent Waste Water Renovation and Solid Waste Composting,
W77-09879 5D
- LIKENS, G. E.**
The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire,
W77-09807 4C
- LIN, C.-Y.**
Buoyant Surface Jets Discharged into a Strong Crossflow,
W77-09926 5B
- LINDSTROM, T.**
The Shore and the Water—The Localization of Damage and the Regulation of Fish Management in Controlled Lakes, (In Swedish),
W77-09935 4A
- LOCATELLI, J. D.**
Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements,
W77-09720 2B
- LOENG, H.**
Deep Water Renewal and Associated Processes in North Norway,
W77-09947 2L
- LOEWENTHAL, R. E.**
Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics,
W77-10087 5F
- LOFTIS, B.**
Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation,
W77-09987 8B
- LONG, R. R.**
Three-Layer Circulations in Estuaries and Harbors,
W77-09723 2L
Three-Layer Circulations in Estuaries and Harbors,
W77-10030 2L
- LORENZEN, M.**
A Guide to Aeration/Circulation Techniques for Lake Management,
W77-09603 5G
- LUDWIG, R. G.**
Advance Sewer Planning for Rio de Janeiro Coastline,
W77-09890 5D
- LUND, L. J.**
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations,
W77-09974 2G
- LURKER, P. A.**
Catalytic Deoxygenation of Aqueous Solutions by Hydrazine,
W77-09766 5B
- LUTADE, S. L.**
Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation,
W77-09863 5D
- LUTZ, F. C.**
A Methodology for Comparative Evaluation of Water Quality Indices,
W77-09632 5A
- MACCABE, R. J.**
Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia,
W77-10076 5G
- MACEK, K. J.**
Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species,
W77-09784 5C
- MACLEOD, D. C.**
Durban Tunnels Under the Microscope,
W77-09689 8A
Sewer-Maintenance Practice and Equipment,
W77-10078 8G
- MACLEOD, J. A.**
Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat,
W77-09655 3F
- MAHOMED, K.**
Observations on the Intestinal Protozoa Infecting Man in Rhodesia,
W77-09691 5F
- MAIER, G. K.**
Cape Town's Steenbras Hydro-Electric Pumped Storage Scheme,
W77-10071 8A
- MAKI, A. W.**
The Freshwater Mussel (*Anodonta* SP.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM),
W77-09765 5C
- MALMSTADT, H. V.**
Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer,
W77-09753 2K
- MALZER, G. L.**
Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates,
W77-09657 3F
- MAMAIEVA, N. V.**
Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian),
W77-10010 5C
- MAMEDOV, A. A.**
Change of Salinity with Different Distances Between Drains Under Conditions of Northern Mugan, (In Russian),
W77-09630 3C
- MARAIS, G. R.**
Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics,
W77-10087 5F
- MARAIS, G. V.**
The Activated Sludge Process, Part 1 - Steady State Behaviour,
W77-10094 5D
- MARINO, M. A.**
Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil,
W77-09653 5B
- MARKING, L. L.**
Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon,
W77-09764 5C
- MARKSTEIN, B.**
Intensive Large City Influence on Reed-Banks, (In German),
W77-09621 5C
- MARTIN, J. P.**
Degradation of a Nonionic Surfactant in Soils and Peat,
W77-09638 5B
- MASTERS, H. E.**
Urban Runoff Pollution Control—Technology Overview,
W77-09823 5D
- MATOCHA, J. E.**
Ammonia Volatilization and Nitrogen Utilization from Sulfur-Coated Ureas and Conventional Nitrogen Fertilizers,
W77-09642 3F
Potassium Sources and Availability on a Deep, Sandy Soil of East Texas,
W77-09972 2G

AUTHOR INDEX

MATTHEWS, J. E.

MATTHEWS, J. E.

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish, W77-09786 5C

MAURER, O. R.

Crop Temperature Modification and Yield Potential in a Dwarf Spring Wheat, W77-09939 3F

MAXWELL, C.

Buoyant Surface Jets Discharged into a Strong Crossflow, W77-09926 5B

MCCABE, P. J.

Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England, W77-09700 2J

MCCORMICK, J. H.

Temperature Effects on Young Yellow Perch, *Perca Flavescens* (Mitchill), W77-09773 5C

MCELROY, A. D.

Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

MCGILLIVARY, P. A.

Steroids as Sewage Specific Indicators in New York Bight Sediments, W77-09901 5A

MCHENNY, R. C.

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

MCKENZIE, E. JR.

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation, W77-09643 2G

MCKENZIE, S. W.

1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A

MCLAFFERTY, F. W.

Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A

MCLAREN, A. D.

Comments on Nitrate Reduction in Unsaturated Soil, W77-09650 2G

MCLEOD, E. A.

Grove Irrigation System, W77-09800 3F

MCWHORTER, D. B.

Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

MEDINA, M. A. JR.

Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts, W77-09874 5D

MEFFERT, M-E.

Analysis of the Population Dynamics of Oscillatoria Redeki Van Goor in Lake Edeberg, W77-09629 5C

MEIER, P. G.

Limnological Investigation of the Muskegon County, Michigan, Wastewater Storage Lagoons. Phase I, W77-10061 5C

MELNICK, J. L.

Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D

Photodynamic Inactivation of Infectious Agents, W77-09883 5D

MELSON, S.

Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C

MERESZ, O.

Determination of Free and Total Potential Haloforms in Drinking Water, W77-09748 5A

MERLINI, M.

Lead and Freshwater Fishes: Part 2--Ionic Lead Accumulation, W77-09779 5C

MERZ, W.

Experiences with the Organic Carbon Analyzer (TOC) by Merz for Routine Monitoring at the BASF Purification Plant (Erfahrungen mit dem TOC-Schnellbestimmer nach Merz in der Routineüberwachung der BASF), W77-09894 5A

METCALF, R. L.

Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975, W77-09769 5A

METRY, A. A.

The Fate of Pollutants in Subsurface Environments, W77-09915 5B

MIERA JR, F. R.

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

MILLER, J. E.

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus, W77-09977 2G

MILLER, P. C.

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

MILLER, R. H.

Microbial Inorganic Polyphosphates: Factors Influencing Their Accumulation, W77-09965 2G

MILLER, R. W.

The Role of Humic Acids in the Uptake and Release of Mercury by Freshwater Sediments, W77-09615 5B

MILLS, H. H.

Basal Till Fabrics of Modern Alpine Glaciers, W77-09704 2C

MIMICOS, N.

Ecological Responses of Phytoplankton on Chronic Oil Pollution, W77-09674 5C

MINER, J. R.

Application of the Rotating Flighted Cylinder to Livestock Waste Management, W77-09795 5D

MOBERG, E. L.

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass, W77-09978 3C

MOONEY, H. A.

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function, W77-09933 2A

MOORE, J. W.

Bottom Withdrawal can Enhance Lake Water Quality, W77-10049 5G

MOORE, L. J.

Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A

MORDEN, G. W.

Rates of Transport of Total Phosphorus and Total Nitrogen in Mackenzie and Yukon River Watersheds, N.W.T. and Y.T., Canada, W77-09617 5C

MORESHET, S.

Effect of Increasing Foliage Reflectance on the CO₂ Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D

MORIN, T. L.

Optimal Operation of Flood Control Systems, (Final Report: V.II), W77-09927 4A

MOROZ, T. G.

Oligochaeta of the Deniester River Mouth Region, (In Russian), W77-10065 2L

MOWLI, P. P.

An Approach to Reduce Water Consumption in Neighborhoods Through Reuse, W77-09855 5D

MUHRING, W.

Matting for the Prevention of Hydraulic Erosion, W77-09798 4D

MULLER, C.

Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C

MUNNS, D. N.

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

MUNROE, V. G.

Using O(xygen) Demand Index, COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A

MUR, L. R.

An Energy Balance for Algal Populations in Light-Limiting Conditions, W77-09609 5C

AUTHOR INDEX

PAINTAL, A. S.

- MURADO, M. A.**
Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon Duck from the Biological Reserve of Donana (Spain),
W77-09677 5A
- MURPHY, K. L.**
Nitrogen Control: Design Considerations for Supported Growth Systems,
W77-09848 5D
- MURPHY, M. P.**
Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts,
W77-09874 5D
- MURRAY, S. P.**
Current Dynamics and Sediment Distribution in the West Mississippi Delta Area,
W77-10032 2L
- MYERS, L. H.**
Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish,
W77-09786 5C
- NAMBIAR, E. K. S.**
The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil,
W77-09930 2G
- NASH, P. A.**
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations,
W77-09974 2G
- NEBGEN, J. W.**
Loading Functions for Assessment of Water Pollution from Nonpoint Sources,
W77-09726 5B
- NEHER, R. E.**
Distribution of Plutonium in Trinity Soils After 28 Years,
W77-09647 5B
- NEILSON, F. M.**
Convex Chutes in Converging Supercritical Flow,
W77-10020 8B
- NELSON, M. E.**
Simulation Factors Involved in Ocean Thermal Power Plants,
W77-10034 5B
- NEWMAN, S. M.**
The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*),
W77-09675 5C
- NICHOLS, M. M.**
Water Color and Circulation Southern Chesapeake Bay. Part I. Southern Chesapeake Bay Water Color and Circulation Analysis, Part II. Skylab Mss Vs. Photography for Estuarine Water Color Classification,
W77-10026 2L
- NICHOLSON, A. A.**
Determination of Free and Total Potential Haloforms in Drinking Water,
W77-09748 5A
- NICHOLSON, S. A.**
Macrophyte-Sediment Relationships in Chautaugua Lake,
W77-09612 5C
- NIEMITZ, W.**
Method for the Determination of the Conditionability of Sewage Sludge (Erarbeitung von Methoden zur Ermittlung der Konditionierbarkeit von Klaufschlaemmen),
W77-09884 5D
- NIX, S. J.**
Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts,
W77-09874 5D
- NOVAK, J. T.**
Storm Water Management Model: Level I-Comparative Evaluation of Storage-Treatment and Other Management Practices,
W77-09824 5D
- NOVAK, J. T.**
Character and Dewatering Properties of Sludges from Water Treatment,
W77-09881 5D
- NOVAK, R. G.**
How Sludge Characteristics Affect Incinerator Design,
W77-09869 5E
- NUMOTO, P. T.**
Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food,
W77-09683 5C
- NYHAN, J. W.**
Distribution of Plutonium in Trinity Soils After 28 Years,
W77-09647 5B
- O'BRIEN, W. J.**
Accommodation of *Daphnia pulex* to Altered pH Conditions as Measured by Feeding Rate,
W77-09678 5C
- O'CONNELL, M. F.**
Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate,
W77-09664 5C
- O'CONNOR, G. A.**
Predicting 2,4,5-T Movement in Soil Columns,
W77-09649 5B
- O'CONNOR, M. P.**
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina,
W77-10036 2L
- O'DONNELL, T. H.**
Fluctuations of Ground-Water Levels in Lee County, Florida, in 1975 Water Year,
W77-10014 2F
- O'LEARY, D. A.**
Impact on Marine Benthos of Waste Water Discharge,
W77-09846 5C
- OBERHOLZER, G.**
The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko),
W77-09690 5G
- OBERTEUFFER, J. A.**
Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation,
W77-09825 5D
- OERTEL, G. F.**
Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal,
W77-10029 2L
- OLIVER, H. R.**
On Penman's Equation for Estimating Regional Evaporation,
W77-09953 2D
- OLIVIER, H.**
The Day They Almost Abandoned the Orange-Fish Tunnel,
W77-10077 8A
- ONESTA, P. A.**
Rainfall Trends in 80 Rainfall Districts of South Africa,
W77-10085 2B
- ONION, C. A.**
Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics,
W77-09993 2E
- ORLOP, G. T.**
Impact on Marine Benthos of Waste Water Discharge,
W77-09846 5C
- OSBORN, J.**
Degradation of a Nonionic Surfactant in Soils and Peat,
W77-09638 5B
- OSEID, D. M.**
Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*),
W77-09668 5C
- OSTERKAMP, W. R.**
Variation of Width and Discharge for Natural High-Gradient Stream Channels,
W77-10009 2E
- OUTLAW, D. G.**
Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design,
W77-10016 8B
- OVERMENT, M.**
Cross Canada Report,
W77-09923 5G
- OVERSTREET, R. M.**
Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, *Paralichthys lethostigma*, and the Sea Catfish, *Arius felis*,
W77-09780 5C
- OWENS, R. W.**
Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal,
W77-09873 5D
- PAGE, A. L.**
Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of Cd by Montmorillonite,
W77-09658 5B
- PAINTAL, A. S.**
Critical and Brink Depths in Elliptical Sewers,
W77-09841 8B

AUTHOR INDEX

PARLANGE, J. Y.

PARLANGE, J. Y.
Relation Between the Kinetics of Nitrogen
Transformation and Biomass Distribution in a
Soil Column During Continuous Leaching,
W77-09973 2G

PARLETTE, J. N.
Gravitational Separator,
W77-09821 5D

PASCOE, D.
The Effect of Parasitism on the Toxicity of
Cadmium to the Three-spined Stickleback,
Gasterosteus aculeatus L.,
W77-09666 5C

PATRICK, W. H. JR.
Ammonium Diffusion as a Factor in Nitrogen
Loss from Flooded Soils,
W77-09966 5B

Nitrite Decomposition in Flooded Soil Under
Different PH and Redox Potential Conditions,
W77-09645 2G

PAULSON, O. L. JR.
Flushing Characteristics of a Mississippi Dead-
End Canal System,
W77-09721 5B

PAVLOVA, N. R.
Oligochaeta of the Deniester River Mouth Re-
gion, (In Russian),
W77-10065 2L

PEIRANO, L. E.
Low Cost Phosphorus Removal at Reno-
Sparks, Nevada,
W77-09849 5D

PEISACH, M.
Dehydration of Marine Zoological Material -
Volatility of Metabolised Selenium at 105-120C,
W77-10095 5A

PEPPER, I. L.
Microbial Inorganic Polyphosphates: Factors
Influencing Their Accumulation,
W77-09965 2G

PEPPER, R. G.
Seepage from Small Earth Dams,
W77-09932 8D

PESSONEY, G. F.
Flushing Characteristics of a Mississippi Dead-
End Canal System,
W77-09721 5B

PETROCELLI, S. R.
Effects of Exposure to Heavy Metals on
Selected Fresh Water Fish. Toxicity of Copper,
Cadmium, Chromium and Lead to Eggs and
Fry of Seven Fish Species,
W77-09784 5C

PETROVA, T. A.
Characteristics of the Zooplankton of the
Lower Reaches of the Irgiz and Turgay Rivers,
(In Russian),
W77-09940 5C

PFEIFF, S.
Design and Operation of Rain Spillways and
Rain Overflow Catchment (Entwurf und
Betrieb von Regenüberläufen (Ru) und Regenu-
berlaufbecken (RUB)),
W77-09822 8B

PHILLIPS, R. E.
Ammonium Diffusion as a Factor in Nitrogen
Loss from Flooded Soils,
W77-09966 5B

PIAGET, J.
Irrigation Requirements of Mature Peach Trees
Under Microjets (Besproeiingsbehoeftes van
volwasse perskebome onder mikrospuite),
W77-10079 3F

PICKARD, B. L.
Impact of Municipal Water and Sewage
Charges on Industry,
W77-09921 5G

PICKERING, R. J.
Water Quality Program of the U.S. Geological
Survey,
W77-10006 5A

PIENAAR, J.
Irrigation Requirements of Mature Peach Trees
Under Microjets (Besproeiingsbehoeftes van
volwasse perskebome onder mikrospuite),
W77-10079 3F

PINGREE, R. D.
The Bottom Mixed Layer on the Continental
Shelf,
W77-09948 2L

PITOUT, M. J.
Microcystis Toxins: Isolation, Identification,
Implications,
W77-10093 5A

POLLOCK, M. J.
Treatment of Denim Textile Mill Wastewaters:
Neutralization and Color Removal,
W77-09724 5D

POST, J.
Potential Environmental Consequences of Ter-
tiary Oil Recovery,
W77-10023 5C

POTTHARST, J. E. JR.
Distillation Apparatus and Method,
W77-09804 3A

POZZI, G.
Lead and Freshwater Fishes: Part 2-Ionic
Lead Accumulation,
W77-09779 5C

PRAATT, P. F.
Sampling the Unsaturated Zone of Irrigated
Lands for Reliable Estimates of Nitrate Con-
centrations,
W77-09974 2G

PRETORIUS, S. J.
The Tugela-Vaal State Water Scheme as a Bil-
harzia Risk (Die Tugela-Vaal-Staatswaterskema
as 'n Bilharziarisiko),
W77-09690 5G

PRUPPACHER, H. R.
Acceleration to Terminal Velocity of Cloud and
Raindrops,
W77-09719 2B

PUGH, L. A. III
A Simple Hand Corer for Shallow Water Sam-
pling,
W77-09715 7B

PUGLISI, F. A.
Effects of Aroclor (R) 1254 on Brook Trout,
Salvelinus Fontinalis,
W77-09783 5C

PULLIN, J.
Options for Sludge-To Land, Sea or Fire,
W77-09918 5E

Saffron Walden Opens Its Low Profile Sewage
Works,
W77-09872 5D

QUINN, R.
Application of Membrane Processes,
W77-09929 3A

RADZIUL, J.
Computer Application in Water and Waste
Water Management: A Panel Discussion,
W77-09903 5D

RAMAMOORTHY, S.
Competition for Mercury Between River Sedi-
ment and Bacteria,
W77-09661 5B

RANEY, D. C.
Lake Erie International Jetport Model Feasi-
bility Investigation; Report 17-4, Numerical
Model Feasibility Study,
W77-10048 8B

RANEY, R. J.
Evaluation of an Evapotranspiration Model for
Corn,
W77-09941 2D

RAO, M. S. V.
Satellite-Derived Global Oceanic Rainfall Atlas
(1973 and 1974),
W77-09693 7C

RAO, T. S.
The Handling of Nitrogenous Wastes in Rural
India,
W77-09900 5D

RAP, A. V. J.
Productivity of *Clarias* *Batrachus* in the
Sewage Fertilized Fish Ponds,
W77-09922 5C

RATIGAN, E.
Oceanographic Water Sampler,
W77-09799 7B

REA, C. C.
The Causes of Erosion to Siletz Spit, Oregon,
W77-10039 2L

REAVELL, P. E.
The Case for the Expanded Study of Fresh-
water Pollution Zoology,
W77-10086 5C

REDDY, K. R.
Ammonium Diffusion as a Factor in Nitrogen
Loss from Flooded Soils,
W77-09966 5B

REGINATO, R. J.
An Evaluation of Total Solar Reflectance and
Spectral Band Ratioing Techniques for Esti-
mating Soil Water Content,
W77-09957 2G

REID, G. W.
Water Reuse in a Paper Reprocessing Plant,
W77-09757 5D

REID, I.
The Origin of Horizontal Laminae in
Ephemeral Stream Channel-Fill,
W77-09950 2J

REMY, F.
Studies and Comparisons of Determinations of
Phenols in Water: Application to the Examina-
tion of a Paper Mill Effluent (Etudes et com-
paraisons des determinations des phenols dans

- les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A
- RENEAU JR., R. B.**
Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table, W77-09907 5B
- RESIO, D. T.**
Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie, W77-09986 8B
- REYNOLDS, W. W.**
Temperature as a Proximate Factor in Orientation Behavior, W77-09680 5C
- RHINEHART, J. F.**
Colorado River Basin Salinity Control Project--Title I, W77-09931 5D
- RHOADES, J. D.**
Effect of Leaching Fraction on River Salinity, W77-09697 5G
- RIBLE, J. M.**
Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations, W77-09974 2G
- RICH, L. G.**
BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D
- RICHARD, F.**
Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G
- RICHARDSON, S. E.**
Water Resources Assessment Methodology (WRAM)--Impact Assessment and Alternative Evaluation, W77-09985 6G
- RIGGS, S. R.**
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina, W77-10036 2L
- ROBBINS, J. L.**
Adsorption of Dodecylbenzene Sulfonate on NA(+)-Montmorillonite: Effect of Salt Impurities, W77-09651 2G
- RODGERS, C. A.**
Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A
- ROGERS, R. H.**
Classifying and Monitoring Water Quality by Use of Satellite Imagery, W77-09634 5A
- ROGERS, S.**
Observations on the Intestinal Protozoa Infecting Man in Rhodesia, W77-09691 5F
- ROLSTON, D. E.**
Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil, W77-09653 5B
- ROOK, J. J.**
Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F
- ROSBJERG, D.**
Return Periods of Hydrological Events, W77-09958 2B
- ROSENTHAL, W. D.**
Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D
- ROTH, I.**
Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A
- ROTHWELL, E. D.**
North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation, W77-10017 8B
- Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation, W77-10018 8B
- ROY, C.**
Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D
- ROZANOV, B. G.**
Scientific Bases of a System for Averting Unfavorable Consequences of Steppe Soil Irrigation, (In Russian), W77-10021 2G
- RUDD, J. W. M.**
Methane Oxidation in a Eutrophic Canadian Shield Lake, W77-09608 5C
- RUDDIMAN, W. F.**
North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present, W77-09706 2J
- RUNNELS, W. C.**
Diatoms in Pond Plankton: Relationships to Epiphytic and Epipelagic Populations, W77-09628 5C
- RUSSELL, G.**
The Effect of Copper on Competition Between Marine Algae, W77-10051 5C
- RYBACKI, R. L.**
Polymer Addition Improves Waste Water Treatment Process, W77-09878 5D
- RYSTAD, B.**
Heavy Metal Tolerance of Marine Phytoplankton. II. Copper Tolerance of Three Species in Dialysis and Batch Cultures, W77-09781 5C
- SAFAYA, N. M.**
Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn, W77-09656 3F
- SAMUELSON, D. F.**
Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A
- SARGENT, R. L.**
Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation, W77-09825 5D
- SAUTER, S.**
Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species, W77-09784 5C
- SAVIJARVI, H.**
Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe, W77-09710 2D
- SAXENA, J.**
Investigation of Selected Potential Environmental Contaminants: Ketonic Solvents, W77-09770 5B
- SCARAMELLI, A. B.**
Effect of Sorbed Organics on the Efficiency of Ammonia Removal by Chloramine-Carbon Surface Reactions, W77-09902 5D
- SCHAFER, R. J. JR.**
Impact of Municipal Water and Sewage Charges on Industry, W77-09921 5G
- SCHAUB, S. A.**
Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D
- SCHELSKE, C. L.**
Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C
- SCHERZ, J. P.**
Classifying and Monitoring Water Quality by Use of Satellite Imagery, W77-09634 5A
- SCHINDLER, A.**
Estimation of Permissible Concentrations of Pollutants for Continuous Exposure, W77-09788 5A
- SCHINDLER, J. E.**
An Investigation of the Role of Organic Materials in Freshwater Systems, W77-09618 5C
- SCHLITTER, W. E.**
Clarifier for Underground Use, W77-10081 5D
- SCHOOR, W. P.**
The Effect of Mirex on the Burrowing Activity of the Lugworm (*Arenicola Cristata*), W77-09675 5C
- SCHROEDER, G.**
Agricultural Wastes in Fish Farming. A Commercial Application of the Culture of Single-Celled Organisms for Protein Production, W77-10050 5E
- SCHULZE, R. E.**
On the Application of Trend Surfaces of Precipitation to Mountainous Areas, W77-10088 2B
- SCHUYTEMA, G. S.**
Effects of Log Handling and Storage on Water Quality, W77-09760 5C

AUTHOR INDEX

SCHUYTEMA, G. S.

- SCOTT, W. E.
Microcystis Toxins: Isolation, Identification, Implications, W77-10093 5A
- SEE, G. G.
Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D
- SEESMAN, P. A.
Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C
- SEKIGUCHI, Y.
Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-10035 5D
- SENECA, E. D.
Animal Colonization of Man-Initiated Salt Marshes on Dredge Spoil, W77-10035 2L
- SHANKLAND, R. D.
Effects of Log Handling and Storage on Water Quality, W77-09760 5C
- SHCHEGLOV, V. V.
Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I
- SHEN, J. H.
Ice Nucleation by Micas, W77-09956 2B
- SHERARD, J. H.
Aeration: Proper Sizing is Critical, W77-09905 5D
- SHIMA, L.
The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing, W77-10007 2H
- SHOWS, L. J.
Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B
- SIDDIQI, R. H.
Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D
- SIMMONS, M. S.
Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C
- SINGH, K. P.
Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation, W77-09943 4A
- SKRESLET, S.
Deep Water Renewal and Associated Processes in North Norway, W77-09947 2L
- SLIGER, H. B.
Application of Membrane Processes, W77-09929 3A
- SLOEY, W. E.
Wastewater Treatment by Natural and Artificial Marshes, W77-09606 5D
- SLY, P. G.
A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C
- SMALL, E. M.
Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge, W77-09850 5D
- SMILLIE, G. W.
Estimation of Components of Soil Cation Exchange Capacity from Measurements of Specific Surface and Organic Matter, W77-09971 2G
- SMIRNOV, N. N.
The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H
- SMITH, J. D.
Water Purifying Systems, W77-09808 5F
- SMITH, J. E. JR.
Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D
- SMITH JR, L. L.
Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (Lepomis macrochirus), W77-09668 5C
- SMITH, O. L.
Nitrogen, Phosphorus, and Potassium Utilization in the Plant-Soil System: An Analytical Model, W77-09964 2I
- SMITH, R. V.
Domestic and Agricultural Contributions to the Inputs of Phosphorus and Nitrogen to Lough Neagh, W77-09722 5B
- SMITH, T. R.
Corrosion Avoidance in Water and Sewage Pipelines, W77-09832 8F
- SMITH, W. E.
Thermal Tolerance of Two Species of Gammarus, W77-09730 5C
- SMOLIK, O.
Analysis of Economic Sewage Lift Station Design, W77-09906 8C
- SNARSKI, V. M.
Effects of Aroclor (R) 1254 on Brook Trout, Salvelinus Fontinalis, W77-09783 5C
- SNYDER, G. H.
Sulfur-Coated Fertilizers for Sugarcane: I. Plant Response to Sulfur-Coated Urea, W77-09640 3F
- Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KCl, W77-09641 3F
- SNYDER, W. M.
Temporally and Areally Distributed Rainfall, W77-09696 2B
- SOLOMON, R. C.
Water Resources Assessment Methodology (WRAM)-Impact Assessment and Alternative Evaluation, W77-09985 6G
- SOMERS, L. H.
Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B
- SOMMERS, L. E.
Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers, W77-09904 5A
- SORBER, C. A.
Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D
- SOUSA, F. DE
Characterization of Spent Bleaching Liquors. Part 1, Spent Liquors from the Chlorine and Alkali Extraction Stages in the Prebleaching of Pine Kraft Pulp, W77-09731 5A
- SPANGLER, F. L.
Wastewater Treatment by Natural and Artificial Marshes, W77-09606 5D
- SPIERS, C. A.
The Cockfield Aquifer in Mississippi, W77-09991 7C
- SPRINGTHORPE, S.
Competition for Mercury Between River Sediment and Bacteria, W77-09661 5B
- SPURR, J.
Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent, W77-09729 5A
- STANDIFER, R. L.
How Sludge Characteristics Affect Incinerator Design, W77-09869 5E
- STANHILL, G.
Effect of Increasing Foliage Reflectance on the CO2 Uptake and Transpiration Resistance of a Grain Sorghum Crop, W77-09942 2D
- STANLEY, R. A.
Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A
- STAPLES, K. D.
Effluent Treatment Versus Disposal Through Long Sea Outfalls, W77-09895 5E
- STARR, J. L.
Relation Between the Kinetics of Nitrogen Transformation and Biomass Distribution in a Soil Column During Continuous Leaching, W77-09973 2G
- STEINHILBER, W. L.
Geohydrology of Muscatine Island, Muscatine County, Iowa, W77-10012 4B

- STEPHENS, R.**
Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C
- STERLING, J. D. E.**
Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat, W77-09655 3F
- STEVENSON, D. R.**
Regular Copolyamides as Desalination Membranes, W77-09806 3A
- STICKNEY, A. P.**
Supersaturation of Atmospheric Gases in the Coastal Waters of the Gulf of Maine, W77-09793 5C
- STOERMER, E. F.**
Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C
Environmental Status of the Lake Michigan Region: Vol. 4. Phytoplankton of Lake Michigan, W77-10056 5C
- STOLZBERG, R. J.**
Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A
- STONE, L. R.**
Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D
- STONIK, V. A.**
Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian), W77-09938 2I
- STRANG, W.**
Construction Management for Waste Water-treatment Plants, W77-09920 5D
- STREEBIN, L. E.**
Water Reuse in a Paper Reprocessing Plant, W77-09757 5D
- STROM, P. F.**
Nitrification in a Chlorinated Activated Sludge Culture, W77-09851 5D
- STUEHRENBURG, L. C.**
The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams, W77-09797 2I
- STURROCK, P. L. K.**
Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics, W77-10087 5F
- SUAREZ, D. L.**
Effect of Leaching Fraction on River Salinity, W77-09697 5G
- SUESS, A.**
Radiation Treatment of Sewage Sludge—Experience with an Operating Pilot Plant, W77-09876 5D
- SUKOPP, H.**
Intensive Large City Influence on Reed-Banks, (In German), W77-09621 5C
- SUTTON, P. M.**
Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D
- SVESHNIKOVA, YE. I.**
Movement of Snow Avalanches, W77-09716 2C
- SWEENEY, C. D.**
Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals, W77-09816 5D
- SWITEK, J.**
Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B
- SWOPE, H. G.**
Zeta Potential Measurement, W77-09908 5A
- SZABO, A.**
Determination of Molybdenum in Seawater by Electron Paramagnetic Resonance Spectrometry, W77-09750 2K
- TAFURI, A. N.**
Urban Runoff Pollution Control—Technology Overview, W77-09823 5D
- TAKAMATSU, T.**
Two-Stage Settling Improves Sludge Removal Efficiency, W77-09875 5D
- TAKASAKI, K. J.**
Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands, W77-09995 5B
- TARAPCHAK, S. J.**
Environmental Status of the Lake Michigan Region: Vol. 4. Phytoplankton of Lake Michigan, W77-10056 5C
- TENOSO, H. J.**
Water System Virus Detection, W77-09636 5A
- TESTORI, G.**
How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera), W77-09738 3E
- THAKUR, U. C.**
Chemical Treatment of Sewage, W77-09892 5D
- THEIS, T. L.**
Studies on the Reclamation of Stone Lake, Michigan, W77-09605 5G
- THEON, J. S.**
Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C
- THOM, A. S.**
On Penman's Equation for Estimating Regional Evaporation, W77-09953 2D
- THOMAS, D. J.**
The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L
- THORNTON, E. J.**
Growth Responses of Chicks Fed Microbial Protein Produced from Organic Wastes, W77-09785 5C
- THORNTON, K. W.**
Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model, W77-09981 5B
- THRUSTON, A. D.**
A Quantitative Method for Toxaphene by GC-MS Specific Ion Monitoring, W77-09633 5A
- THYRUM, P. T.**
Method for Detecting Oil in Water, W77-09813 5A
- TOEREN, D. F.**
Microcystis Toxins: Isolation, Identification, Implications, W77-10093 5A
- TOFFLEMIRE, T. J.**
Restoration of Lower St. Regis Lake (Franklin County, New York), W77-10054 5C
- TOOL, A. R.**
Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B
- TRAVERSE, C. E.**
Method and Apparatus for Aerobic Sewage Treatment, W77-09805 5D
- TREPL, L.**
Intensive Large City Influence on Reed-Banks, (In German), W77-09621 5C
- TRIPATHI, P. N.**
Nirmali Seed—A Naturally Occurring Coagulant, W77-09861 5D
- TRIPLETT, G. B. JR.**
Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield, W77-09969 3F
- TROFIMOVA, YE. B.**
Mathematical Description of Some Physical Snow Cover Characteristics, W77-09717 2C
- TSAL, C. F.**
Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C
- TURNER, J. E.**
Underground Irrigation Porous Pipe, W77-09810 3F

AUTHOR INDEX

TYLER, P. A.

TYLER, P. A.

The Effect of Coastal Hydrodynamics on the Echinoderm Distribution in the Sublittoral of Oxwich Bay, Bristol Channel,
W77-09944 2L

UDA, T.

A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei osenbusshitsu nado no eikyo o koryo shita kaiki no suishitsu no yosoku-moderu no kaihatsu ni kansuru kenkyu),
W77-09911 5B

UHTE, W. R.

Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant,
W77-09854 5D

VALORAS, N.

Degradation of a Nonionic Surfactant in Soils and Peat,
W77-09638 5B

VALUTINA, V. A.

Destruction of Vegetation on Dams of the Gorky Hydroelectric Power Plant with Herbicides,
W77-10059 4A

VAN CLEEMPOT, O.

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions,
W77-09645 2G

VAN DER MEER, C.

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae,
W77-09663 5C

VAN DER SLOOT, H. A.

The Determination of Molybdenum and Tungsten in Sea and Surface Water,
W77-09754 5A

VAN DIJK, J. J.

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae,
W77-09663 5C

VAN DOREN, D. M. JR.

Influence of Long Term Tillage, Crop Rotation, and Soil Type Combinations on Corn Yield,
W77-09969 3F

VAN EEDEN, J. A.

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziasisiko),
W77-09690 5G

VAN GENUCHTEN, M. TH.

Predicting 2,4,5-T Movement in Soil Columns,
W77-09649 5B

VAN GRIEKEN, R. E.

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon,
W77-09752 5A

VAN ROBBROECK, T. P.

Hydro-Electric Development of the Tugela River,
W77-10073 8C

VAN STEENDEREN, R. A.

Parameters which Influence the Organic Carbon Determination in Water,
W77-10092 5A

VAN ZYL, J.

Irrigation Requirements of Mature Peach Trees Under Microjets (Besproeiingsbehoefte van volwasse perskebome onder mikrospruite),
W77-10079 3F

VANDEMARK, S. C.

Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil,
W77-09654 5D

VANDEBORGHT, B. M.

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon,
W77-09752 5A

VANDERHORST, J. R.

Continuous-Flow Apparatus for Use in Petroleum Bioassay,
W77-09681 5A

VASIL'EVA, G. L.

The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian),
W77-10064 2H

Method of Analyzing Some Experimental Data on Zooplankton, (In Russian),
W77-10038 2I

VEDDER, J. F.

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content,
W77-09957 2G

VERHOEF, P.

Rainfall Trends in 80 Rainfall Districts of South Africa,
W77-10085 2B

VERLEY, W. E.

Application of the Rotating Flighted Cylinder to Livestock Waste Management,
W77-09795 5D

VERPLANCKE, H.

An Automatic Scanning Apparatus for Gamma Spectrometry for the Determination of the Moisture Content in Soil Columns, (In Dutch),
W77-09613 2G

VETROV, V. A.

Dilution Characteristics of Effluents in Deep Water Reservoirs Determined with a Radioactive Indicator (On the Example of Lake Baikal), (In Russian),
W77-09735 5B

VINCENT, C. L.

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie,
W77-09986 8B

VIRTA, J.

Estimating the Water and Salt Budgets of a Stratified Estuary,
W77-09709 2L

VOGEL, A. H.

A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model,
W77-09631 5C

VOGL, O. F.

Regular Copolyamides as Desalination Membranes,
W77-09806 3A

VOLESKY, B.

Activated Carbon Adsorption Process for Purification of Textile Waste Waters,
W77-09744 5D

WADDINGTON, D. V.

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass,
W77-09978 3C

WAGNER, R.

Study of the Decomposition of Organic Matter by the Respirometric Dilution Method (Untersuchungen ueber das Abbauverhalten organischer Stoffe mit Hilfe der respirometrischen Verduennungsmethode),
W77-09888 5D

WALKER, G. R.

A Unique Means of Obtaining Sea-Water,
W77-09692 8E

WALKER, J. D.

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria,
W77-09772 5C

WALLIS, C.

Disinfection of Waste Water by Photodynamic Oxidation,
W77-09852 5D

Photodynamic Inactivation of Infectious Agents,
W77-09883 5D

WALS, G. D.

The Determination of Molybdenum and Tungsten in Sea and Surface Water,
W77-09754 5A

WALTON, H. F.

Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin,
W77-09749 5A

WANG, P. K.

Acceleration to Terminal Velocity of Cloud and Raindrops,
W77-09719 2B

WANSTRATH, J. J.

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill),
W77-10041 8B

WARD, R. L.

Identification of the Virucidal Agent in Waste Water Sludge,
W77-09897 5A

WARDAK, S. G.

A Dynamic Water Quality Model for the Neuse Estuary, N.C.,
W77-10037 5B

WASS, W. E.

How Sludge Characteristics Affect Incinerator Design,
W77-09869 5E

WATSCHKE, T. L.

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass,
W77-09978 3C

WATSON, R. L.

Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History, 1973-75,
W77-09982 2L

WEGNER, B. J.

Simulation Factors Involved in Ocean Thermal Power Plants,
W77-10034 5B

- WEISS, R. R. SR.**
Deduction of Ice Particle Types in the Vicinity of the Melting Layer from Doppler Radar Measurements, W77-09720 2B
- WEKELL, M. M.**
Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C
- WELCH, E. B.**
Nutrient Diversion: Resulting Lake Trophic State and Phosphorus Dynamics, W77-09604 5G
- WELLS, A. F.**
Water System Virus Detection, W77-09636 5A
- WESTMAN, J. R.**
The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, *Umbra pygmaea* (DeKay), W77-09670 5C
- WHALIN, R. W.**
Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design, W77-10016 8B
- WHEATLEY, A. D.**
Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D
- WHEELER, J.**
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Vol. II - Holston - Final Report, W77-09762 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants - Volume I - Radford, W77-09761 5C
Aquatic Field Surveys at Radford, Holston, Volunteer, and Milan Army Ammunition Plants, Volume IV - Milan, Final Report, W77-09763 5C
- WHITE, J.**
Potential Environmental Consequences of Tertiary Oil Recovery, W77-10023 5C
- WHITE, J. T.**
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods, W77-09759 5D
- WHITE, S. C.**
BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D
- WHITEMORE, D. O.**
Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B
- WIBBEN, H. C.**
Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve Flood-Frequency Estimates on Small Tennessee Streams, W77-10004 2A
- WIDMER, P.**
A New Rapid Digestion Process for Sewage Sludge Utilization (Ein neues Schnellrotte-Verfahren als Beitrag zur weitergehenden Klärschlamm-Verwertung), W77-09887 5D
- WIEBE, A. H.**
The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C
- WIERENGA, P. J.**
Predicting 2,4,5-T Movement in Soil Columns, W77-09649 5B
- WIJANAMS, M.**
The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae, W77-09663 5C
- WIJSMAN, T. C. M.**
ATP Content and Mortality in *Mytilus Edulis* from Different Habitats in Relation to Anaerobiosis, W77-09671 5C
- WIKEY, A.**
Water Treatment System with Prolonged Aeration, W77-09818 5G
- WILHELMS, S. C.**
Bay Springs Lake Water-Quality Study, W77-10055 5B
Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation, W77-09987 8B
- WILKINSON, P.**
Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A
- WILLIAMS, I. L.**
Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D
- WILLIAMS, R.**
Flushing Characteristics of a Mississippi Dead-End Canal System, W77-09721 5B
- WILSON, R. E.**
A Model of Dynamics in the Lower Potomac River Estuary, W77-09714 2L
- WILSON, R. W.**
Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D
- WINDOM, H. L.**
Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments, W77-09767 5B
- WISEMAN, W. J. JR.**
Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L
- WISHART, C.**
Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B
- WITTENBERG, L. A.**
1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon, W77-10015 5A
- WRASIDLO, W. J.**
Semipermeable Membranes and the Method for the Preparation Thereof, W77-09817 3A
- WRIGHT, L. D.**
Sediment Transport and Deposition at River Mouths: A Synthesis, W77-09705 2J
- WUHRMANN, K.**
Experiments on the Effects of Inorganic Enrichment of Rivers on Periphyton Primary Production, W77-09625 5C
Growth and Photosynthesis During the Formation of a Benthic Algal Community, W77-09627 5C
- WYMAN, F. H.**
Liquid Filtering Apparatus, W77-09820 5D
- YAREMENKO, V. V.**
Ecology of the Azov Vimba, *Vimba Vimba Carinata* (Pall.), of the Tsimlyansk Reservoir, (In Russian), W77-09610 2H
- YEFIMOV, M. K.**
Relation of Some Meteorological Elements to Avalanching in the Dukant River Basin (Western Tien-Shan), W77-09718 2C
- YOUNG, G. K.**
Impact of Economic Risks on Box Culvert Designs--An Application to 22 Virginia Sites, W77-10067 8B
- ZANONI, A. E.**
Review and Evaluation of Aeration Tank Design Parameters, W77-09870 5D
- ZASCHKE, W.**
Static Calculation of Drainage Channels and Pipes (Die statische Berechnung von Entwässerungskanälen und -leitungen), W77-09833 8G
- ZAVODNIK, N.**
Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C
- ZETTLEMOYER, A. C.**
Ice Nucleation by Micas, W77-09956 2B
- ZIELINSKI, J.**
Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwróconej osmozy i ultrafiltracji do oczyszczania ścieków z przemysłu celulozowo-papierniczego), W77-09733 5D
- ZIEMANN, H.**
Concerning the Influence of the Hydrogen Ion Concentration and of the Bicarbonate Concentration on the Structure of Biocenoses of Mountain Brooks, (In German), W77-09620 2I

AUTHOR INDEX

ZOLTEK, J. JR.

ZOLTEK, J. JR.

Recycling of Alum Used for Phosphorus
Removal in Domestic Waste Water Treatment,
W77-09847 5D

Removal of Nutrients from Treated Municipal
Waste Water by Wetland Vegetation,
W77-09916 5D

ORGANIZATIONAL INDEX

ADELAIDE UNIV. (AUSTRALIA). DEPT. OF AGRONOMY.

The Effects of Water Content of the Topsoil on Micronutrient Availability and Uptake in a Siliceous Sandy Soil,
W77-09930 2G

AEROSPACE MEDICAL RESEARCH LAB., WRIGHT-PATTERSON AFB, OHIO.

Catalytic Deoxygenation of Aqueous Solutions by Hydrazine,
W77-09766 5B

AG-RAIN INC., HAVANA, ILL. (ASSIGNEE).

Traveling Irrigation Sprinkler,
W77-09811 3F

AGRICULTURAL RESEARCH ORGANIZATION, DOR (ISRAEL). FISH AND AQUACULTURE STATION.

Agricultural Wastes in Fish Farming. A Commercial Application of the Culture of Single-Celled Organisms for Protein Production,
W77-10050 5E

AGRICULTURAL RESEARCH SERVICE, ATHENS, GA. SOUTHEAST WATERSHED LAB.

Temporally and Areally Distributed Rainfall,
W77-09696 2B

AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, COLO.

Picloram Degradation in Soils as Influenced by Soil Water Content and Temperature,
W77-09644 5B

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER CONSERVATION LAB.

An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content,
W77-09957 2G

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY LAB.

Effect of Leaching Fraction on River Salinity,
W77-09697 5G

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF HYDROLOGY AND CATCHMENT HYDROLOGY.

Brink Depth Method in Rectangular Channel,
W77-09695 8B

AIR FORCE CIVIL ENGINEERING CENTER, TYNDALL AFB, FLA.

Continuous On-Line Monitoring of Total Organic Carbon,
W77-09635 5A

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT BIOLOGII VNUTRENNYKH VOD.

Planktonic Ciliates in the Ivan'kovo Water Reservoir, (In Russian),
W77-10010 5C

AKADEMIYA NAUK SSSR, VLADIVOSTOK. INSTITUT BIOLOGII.

Comparative Study of the Antifungal Activity of Triterpene Glycosides of Pacific Holothurians, (In Russian),
W77-09938 2I

AKADEMIYA NAUK URSR, KIEV. INSTYTUT BOTANIKI.

Ecological and Topographic Series of Vegetation of Erosion Forms of Relief in the Northeast of the Chernigov Territory, (In Ukrainian),
W77-09622 2I

AKADEMIYA NAUK URSR, KIEV. INSTYTUT HIDROBIOLOGII.

Oligochaeta of the Deniester River Mouth Region, (In Russian),
W77-10065 2L

ALABAMA AGRICULTURAL EXPERIMENT STATION, AUBURN. DEPT. OF SOILS.

Solubility and Solubility Product of Dicalcium Phosphate Dihydrate in Aqueous Solutions and Soil Solutions,
W77-09979 2G

ALBANY MUSEUM, GRAHAMSTOWN (SOUTH AFRICA).

Further Important Features of the Fish Fauna of the Clanwilliam Olifants River System, Southwestern Cape,
W77-10090 2E

AMERICAN COLOR AND CHEMICAL CORP., LOCK HAVEN, PA. (ASSIGNEE).

Method for Treating Effluent Resulting from the Manufacture of Synthetic Dyestuffs and Related Intermediate Chemicals,
W77-09816 5D

AMSTERDAM UNIV. (NETHERLANDS). PHARMACOLOGICAL LAB.

The Toxicity of Sodium Pentachlorophenolate for Three Species of Decapod Crustaceans and Their Larvae,
W77-09663 5C

ANDHRA UNIV., WALT AIR (INDIA). DEPT. OF ENVIRONMENTAL ENGINEERING.

The Handling of Nitrogenous Wastes in Rural India,
W77-09900 5D

ANTWERP UNIV., WILRIJK (BELGIUM). DEPT. OF CHEMISTRY.

Enrichment of Trace Metals in Water by Adsorption on Activated Carbon,
W77-09752 5A

ARGONNE NATIONAL LAB., ILL.

Uptake of Cadmium by Soybeans as Influenced by Soil Cation Exchange Capacity, pH and Available Phosphorus,
W77-09977 2G

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF CIVIL ENGINEERING.

Bottom Withdrawal can Enhance Lake Water Quality,
W77-10049 5G

ARMY ENGINEER DISTRICT, WILMINGTON, N.C.

The Georgia Coastal Environment. A Compilation of Resource Materials Covering the Coastal Plain, Estuaries and Offshore Waters.
W77-10025 2L

ARMY ENGINEER WATERWAY EXPERIMENT STATION, VICKSBURG, MISS.

Lake Erie International Jetport Model Feasibility Investigation; Report 17-4, Numerical Model Feasibility Study,
W77-10048 8B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.

Sensitivity Analysis of the Water Quality for River-Reservoir Systems Model,
W77-09981 5B

Effect of Source Orientation and Location in the Peru-Chile Trench on Tsunami Amplitude

Along the Pacific Coast of the Continental United States,
W77-09983 2L

Stability of Rubble-Mound Breakwater Jubail Harbor, Saudi Arabia; Hydraulic Model Investigation,
W77-09984 8B

Water Resources Assessment Methodology (WRAM)—Impact Assessment and Alternative Evaluation,
W77-09985 6G

Seasonal Variations in Great Lakes Design Wave Heights: Lake Erie,
W77-09986 8B

Dickey-Lincoln School Lakes Hydrothermal Model Study; Hydraulic Laboratory Investigation,
W77-09987 8B

Lake Dardanelle, Arkansas River; Hydraulic Model Investigation,
W77-09988 8B

Design for Small-Boat Harbor Improvements, Port Washington Harbor, Wisconsin; Hydraulic Model Investigation,
W77-09989 8B

Igloo Wave Absorber Tests for Port Washington Harbor, Wisconsin; Hydraulic Model Investigation,
W77-09990 8B

Los Angeles and Long Beach Harbors Model Study; Report 4, Model Design,
W77-10016 8B

North Fork Lake Spillway San Gabriel River, Texas; Hydraulic Model Investigation,
W77-10017 8B

Old River Existing Low-Sill Control Structure, Louisiana; Hydraulic Model Investigation,
W77-10018 8B

Charleston Harbor Navigation Study, South Carolina, Verification Tests; Hydraulic Model Investigation,
W77-10019 8B

Convex Chutes in Converging Supercritical Flow,
W77-10020 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 2, Alternate Plans for Pier J Completion and Tanker Terminal Project,
W77-10040 8B

Long Beach Harbor Numerical Analysis of Harbor Oscillations; Report 4, Alternate Plans for Pier J Completion and Tanker Terminal Project (No Landfill),
W77-10041 8B

Los Angeles Harbor Numerical Analysis of Harbor Oscillations,
W77-10042 8B

Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation,
W77-10043 8B

Center Sluice Investigation, Libby Dam Kootenai River, Montana; Hydraulic Model Investigation,
W77-10044 8B

ORGANIZATIONAL INDEX

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.

Sluice Pressures, Gate Vibrations and Stilling Basin Wall Pressures Libby Dam, Kootenai River, Montana, W77-10045 8B

Divide Cut Drainage Structures Tennessee-Tombigbee Waterway Mississippi and Alabama; Hydraulic Model Investigation, W77-10046 8B

Entrance to Upstream Approach Canal, Gainesville Lock, Tombigbee River, Mississippi and Alabama; Hydraulic Model Investigation, W77-10047 8B

Butoxyethanol Ester of 2,4-D for Control of Eurasian Water Milfoil, W77-10057 4A

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS. HYDRAULICS LAB.

Bay Springs Lake Water-Quality Study, W77-10055 5B

ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LAB., FORT DETRICK, MD.

Virus and Bacteria Removal from Waste Water by Rapid Infiltration Through Soil, W77-09860 5D

ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER, FORT BELVOIR, VA. SANITARY SCIENCES DIV.

A Study to Evaluate the Intensity of an Alternate Methods for Neutralization of DOD Aircraft Fuel Spills, Phase I, W77-09774 5G

ARMY VETERINARY CORPS, ABERDEEN PROVING GROUNDS, MD. VETERINARY PATHOLOGY BIOMEDICAL LABS.

Histopathologic Alterations in Shell Gland Accompanying DDT-Induced Thinning of Eggshell, W77-09673 5C

ARNOLD, ARNOLD AND ASSOCIATES, SEATTLE, WASH.; AND DAMES AND MOORE, SEATTLE, WASH.

Logging Roads and Protection of Water Quality, W77-09725 5G

ASEA ELECTRIC (AUSTRALIA) PTY LTD., LILLYDALE.

Purification Plant Project, W77-09889 5D

ASTON UNIV., BIRMINGHAM (ENGLAND).

Pilot-Scale Investigations into the Use of Random-Pack Plastics Filter Media in the Complete Treatment of Sewage, W77-09830 5D

ASTON UNIV., BIRMINGHAM (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.

Toxic Action of Several Lethal Concentrations of an Anionic Detergent on the Gills of the Brown Trout (*Salmo trutta* L.), W77-09672 5C

AUSSENINSTITUT FUER MOORFORSCHUNG UND ANGEWANDTE BODENKUNDE, BREMEN (WEST GERMANY).

Influences of Some Peat Soil Features on the Capillary Water Supply, (In German), W77-09626 2G

AUSTRALIAN NATIONAL UNIV., CANBERRA. DEPT. OF BIOGEOGRAPHY AND GEOMORPHOLOGY.

Calcium Carbonate Formation by Enteromorpha Nana Algae in a Hypersaline Volcanic Crater Lake, W77-09787 2H

BALLAS (GEORGE C.), HOUSTON, TEX. (ASSIGNEE).

Underground Irrigation Porous Pipe, W77-09810 3F

BATTELLE PACIFIC NORTHWEST LABS., SEQUIM, WASH. MARINE RESEARCH LABS.

Continuous-Flow Apparatus for Use in Petroleum Bioassay, W77-09681 5A

BAYERISCHE LANDESANSTALT FUER BODENKULTUR, PFLANZENBAU UND PFLANZENSCHUTZ, MUNICH (WEST GERMANY).

Radiation Treatment of Sewage Sludge-Experience with an Operating Pilot Plant, W77-09876 5D

BAYLOR COLL. OF MEDICINE, HOUSTON, TEX. DEPT. OF VIROLOGY AND EPIDEMIOLOGY.

Disinfection of Waste Water by Photodynamic Oxidation, W77-09852 5D

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). MARINE ECOLOGY LAB.

Short Term Variability in Vertical Chlorophyll Structure, W77-09702 2L

BESANCON UNIV. (FRANCE). INSTITUT DE CHIMIE.

Studies and Comparisons of Determinations of Phenols in Water: Application to the Examination of a Paper Mill Effluent (Etudes et comparaisons des determinations des phenols dans les eaux: application a l'examen d'un rejet de papeterie), W77-09736 5A

BHAGALPUR ENGINEERING COLL. (INDIA). DEPT. OF CIVIL ENGINEERING.

Nirmali Seed-A Naturally Occurring Coagulant, W77-09861 5D

BIOLOGO-GEORAFICHESKII NAUCHNO-ISSLEDOVATELSKII INSTITUT, IRKUTSK (USSR).

Effluents of Kraft Mills and Their Toxicity for Hydrobionts (Stokhnye vody sul'fat-sellyuloznykh zavodov i ikh toksichnost' dlya gidrobiontov), W77-09739 5C

Method of Analyzing Some Experimental Data on Zooplankton, (In Russian), W77-10038 2I

BIRBECK COLL., LONDON (ENGLAND). DEPT. OF GEOLOGY; AND BIRBECK COLL., LONDON (ENGLAND). DEPT. OF GEOLOGY;

The Origin of Horizontal Laminiae in Ephemeral Stream Channel-Fill, W77-09950 2J

BRISTOL UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.

A Laboratory Model to Investigate the Soil Moisture Conditions on a Draining Slope, W77-09712 2G

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF GEOLOGICAL SCIENCES.

Interactions Between Zinc and Suspended Sediments in the Fraser River Estuary, British Columbia, W77-09949 5B

BRITISH COLUMBIA UNIV., VANCOUVER. INST. OF OCEANOGRAPHY.

The Effect of Exchange Reactions Between Fraser River Sediment and Seawater on Dissolved Cu and Zn Concentrations in the Strait of Georgia, W77-09707 2L

BRITISH COLUMBIA WATER RESOURCES SERVICE, VICTORIA.

Annotated Extracts of Some Papers Dealing with the Measurement and Solubility of Dissolved Atmospheric Gases, with Nitrogen Gas Supersaturation, and with Gas Bubble Disease in Fish, W77-09792 5C

BROWN AND CALDWELL, WALNUT CREEK, CALIF.

Upgrading a Complex Mix Activated Sludge Wastewater Treatment Plant, W77-09854 5D

BUREAU OF COMMERCIAL FISHERIES, BEAUFORT, N.C.

Influence of Certain Water Conditions, Especially Dissolved Gasses, on Trout, W77-09790 5C

BUREAU OF FISHERIES LAB., FARIPORT, IOWA.

The Effect of High Concentrations of Dissolved Oxygen on Several Species of Pond Fishes, W77-09789 5C

BUREAU OF MINES, ANCHORAGE, ALASKA. ALASKA FIELD OPERATION CENTER.

Oil and Gas Seeps in Alaska. Alaska Peninsula, Western Gulf of Alaska, W77-10033 5B

BUREAU OF RECLAMATION, YUMA, ARIZ. YUMA PROJECTS OFFICE.

Colorado River Basin Salinity Control Project--Title I, W77-09931 5D

C AND G ENGINEERING, SALEM, OREG.

Demonstrating the Feasibility of Vacuum and Pressure Sewers, W77-09834 5D

CALIFORNIA UNIV., BERKELEY. DEPT. OF SOIL BIOLOGY.

Comments on Nitrate Reduction in Unsaturated Soil, W77-09650 2G

CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING.

Impact on Marine Benthos of Waste Water Discharge, W77-09846 5C

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.

Simultaneous Transport of Nitrate and Gaseous Denitrification Products in Soil, W77-09653 5B

ORGANIZATIONAL INDEX

CROMPTON AND KNOWLES CORP., READING, PA.

CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND PLANT NUTRITION.

The Slow Reaction which Continues After Phosphate Adsorption: Kinetics and Equilibrium in Some Tropical Soils, W77-09980 2G

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ATMOSPHERIC SCIENCES.

Acceleration to Terminal Velocity of Cloud and Raindrops, W77-09719 2B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL PHYSICS.

Degradation of a Nonionic Surfactant in Soils and Peat, W77-09638 5B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL SCIENCE AND AGRICULTURAL ENGINEERING.

Determination of Hydraulic Parameters to Estimate Water Movement and Water Storage in Undisturbed Soil: Comparison of Field and Laboratory Methods, (In German), W77-09624 2G

Influence of Ionic Strength and Inorganic Complex Formation on the Sorption of Trace Amounts of CD by Montmorillonite, W77-09658 5B

Sampling the Unsaturated Zone of Irrigated Lands for Reliable Estimates of Nitrate Concentrations, W77-09974 2G

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF ENGINEERING.

The Identification and Adaptive Prediction of Urban Sewer Flows, W77-09914 5B

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).

A Report on Studies of the Effects of Dredging and Disposal in the Great Lakes with Emphasis on Canadian Waters, W77-09794 5C

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF CIVIL ENGINEERING.

Calcium Carbonate Precipitation Kinetics, Part I, Pure System Kinetics, W77-10087 5F

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF WATER RESOURCES AND PUBLIC HEALTH ENGINEERING.

The Activated Sludge Process, Part 1 - Steady State Behaviour, W77-10094 5D

CARTIERE AMBROGIO BINDA S.P.A., MILAN (ITALY).

How to Reduce Water and Raw Material Consumption in Papermaking (Come ridurre i consumi d'acqua e di materie prime in cartiera), W77-09738 3E

CHEVRON OIL FIELD RESEARCH CO., LA HABRA, CALIF.

Adsorption of Dodecylbenzene Sulfonate on NA(+) Montmorillonite: Effect of Salt Impurities, W77-09651 2G

CIVIL ENGINEERING LAB. (NAVY), PORT HUENEME, CALIF.

Evaluation of Utility Equipment for Harbor Oil Spill Removal/Recovery Systems, W77-10031 5G

CLEMSON UNIV., S.C. DEPT. OF AGRONOMY AND SOILS.

Movement of Carbaryl Through Congaree Soil into Ground Water, W77-09976 5B

CLEMSON UNIV., S.C. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.

Mercury Accumulation by Largemouth Bass (Micropterus salmoides) in Recently Impounded Reservoirs, W77-09667 5C

BOD5 Removal from Aerated Lagoon Systems, W77-09913 5D

CM ASSOCIATES, INC., HOUSTON, TEX.

Construction Management for Waste Water-treatment Plants, W77-09920 5D

COAST GUARD RESEARCH AND DEVELOPMENT CENTER, GROTON, CONN.

Oil Spill Identification System, W77-10024 5A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL ENGINEERING.

Drain Spacing Based on Dynamic Equilibrium, W77-09698 2F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ATMOSPHERIC SCIENCE.

Precipitation Trend and Storm Analysis in Colorado, W77-09685 2C

COLORADO UNIV., BOULDER. DEPT. OF CHEMISTRY.

Chromatography of Chlorinated Biphenyls on an Ion-Exchange Resin, W77-09749 5A

COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY). JOINT RESEARCH CENTRE.

Lead and Freshwater Fishes: Part 2-Ionic Lead Accumulation, W77-09779 5C

COMMISSION OF THE EUROPEAN COMMUNITIES, PETTEN (NETHERLANDS). JOINT NUCLEAR RESEARCH CENTER.

The Determination of Molybdenum and Tungsten in Sea and Surface Water, W77-09754 5A

COMMUNITY COLL. OF THE FINGER LAKES, CANANDAIGUA, NEW YORK.

Long-Term Evaluation of Slow-Release Nitrogen Sources of Turfgrass, W77-09978 3C

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.

Relation Between the Kinetics of Nitrogen Transformation and Biomass Distribution in a Soil Column During Continuous Leaching, W77-09973 2G

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, MADRID (SPAIN). INSTITUTO DE QUIMICA ORGANICA GENERAL.

Organochlorine Pesticides and PCBs Distribution in Tissues of Purple Heron and Spoon

Duck from the Biological Reserve of Donana (Spain), W77-09677 5A

COPENHAGEN UNIV. (DENMARK). INST. OF PHYSICAL OCEANOGRAPHY.

Transmission Spectroscopy Examinations of Natural Waters-C. Ultraviolet Spectral Characteristics of the Transition From Terrestrial Humus to Marine Yellow Substance, W77-09945 5A

Entrainment Velocity in Natural Stratified Vertical Shear Flow, W77-09946 2L

CORNELL UNIV. AGRICULTURAL EXPERIMENT STATION, ITHACA, N. Y. DEPT. OF AGRONOMY.

Microbial Formation of Volatile Selenium Compounds in Soil, W77-09648 2G

CORNELL UNIV., ITHACA, N.Y.

Computer Interpretation of Pollutant Mass Spectra, W77-09776 5A

CORNELL UNIV., ITHACA, N.Y. DEPT. OF THERMAL ENGINEERING.

How a Heat Pump Improved Water Conditions at a Fish Hatchery, W77-09791 5C

CORNELL UNIV., ITHACA, N.Y. SECTION OF ECOLOGY AND SYSTEMATICS.

The Effect of Strip-Cutting on Stream Temperatures in the Hubbard Brook Experimental Forest, New Hampshire, W77-09807 4C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OREG.

Effects of Log Handling and Storage on Water Quality, W77-09760 5C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OREG. WESTERN FISH TOXICOLOGY STATION.

Water Quality: Western Fish Toxicology Station and Western Oregon Rivers, W77-09777 5A

COSULICH (WILLIAM F.) ASSOCIATES, WOODBURY, N. Y.

Co-Burning of Sludge and Refuse with Waste Heat Recovery, W77-09857 5E

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA).

Mercury Detection Simplified, W77-10084 5A

Environmental Sciences, W77-10098 6G

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA). GEOPHYSICS DIV.

Electrical Water Prospecting, W77-10100 2F

CROMPTON AND KNOWLES CORP., READING, PA.

Characterization and Treatment of Textile Dyeing Wastewaters, W77-09745 5D

ORGANIZATIONAL INDEX

DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.

DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.
Evaporation from a Warm, Wavy Surface: A Laboratory Study,
W77-09954 2D

DEMOCRITUS NUCLEAR RESEARCH CENTER, ATHENS (GREECE). DEPT. OF BIOLOGY.
Ecological Responses of Phytoplankton on Chronic Oil Pollution,
W77-09674 5C

DEPARTMENT OF AGRICULTURE, CHARLOTTETOWN (PRINCE EDWARD ISLAND). RESEARCH STATION.
Effects of Boron and Nitrogen on Grain Yield and Boron and Nitrogen Concentrations of Barley and Wheat,
W77-09655 3F

DEPARTMENT OF AGRICULTURE, LONDON (ONTARIO). RESEARCH INST.
Influence of Cation Content on the Biological Activity of Fensulfathion in Plainfield Sand,
W77-09639 2G

DEPARTMENT OF FORESTRY, PRETORIA (SOUTH AFRICA).
Stabilization of Sand Dunes in the West Sahara,
W77-10074 4A

DEPARTMENT OF INDUSTRIES, CAPE TOWN (SOUTH AFRICA). DIV. OF SEA FISHERIES.
Dehydration of Marine Zoological Material - Volatility of Metabolised Selenium at 105-120C,
W77-10095 5A

DEPARTMENT OF THE INTERIOR, WASHINGTON, D.C. OFFICE OF THE SECRETARY.
Regular Copolyamides as Desalination Membranes,
W77-09806 3A

Semipermeable Membranes and the Method for the Preparation Thereof,
W77-09817 3A

DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA).
Hydro-Electric Development of the Tugela River,
W77-10073 8C

DERBY BOROUGH COUNCIL (ENGLAND) DRAINAGE SECTION.
Chellaston Trunk Foul Sewer. Some Interesting Aspects of the Scheme,
W77-09837 5D

DONOHUE AND ASSOCIATES, INC., WAUKESHA, WIS.
Review and Evaluation of Aeration Tank Design Parameters,
W77-09870 5D

DORR-OLIVER, INC., STAMFORD, CONN.
Gravity Thickening of Water-Treatment-Plant Sludges,
W77-09912 5D

DURBAN CITY ENGINEERS DEPT. (SOUTH AFRICA).
Durban Tunnels Under the Microscope,
W77-09689 8A
Sewer-Maintenance Practice and Equipment,
W77-10078 8G

EAST CAROLINA UNIV., GREENVILLE, N.C. DEPT. OF BIOLOGY; AND EAST CAROLINA UNIV., GREENVILLE, N.C. DEPT. OF GEOLOGY.
Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina,
W77-10036 2L

ECOLOGOTROL, INC., BETHPAGE, N.Y.
Biological Fluidized-Bed Treatment for BOD and Nitrogen Removal,
W77-09873 5D

EDINBURGH UNIV. (SCOTLAND). DEPT. OF METEOROLOGY.
On Penman's Equation for Estimating Regional Evaporation,
W77-09953 2D

EG AND G BIONOMICS, WAREHAM, MASS. AQUATIC TOXICOLOGY LAB.
Effects of Exposure to Heavy Metals on Selected Fresh Water Fish. Toxicity of Copper, Cadmium, Chromium and Lead to Eggs and Fry of Seven Fish Species,
W77-09784 5C

ENCIBRA SOUTH AMERICA, RIO DE JANEIRO (BRAZIL).
Advance Sewer Planning for Rio de Janeiro Coastline,
W77-09890 5D

ENERGY RESOURCES CO., CAMBRIDGE, MASS.
Soil Temperatures and Heat Loss for a Hot Pipe Network Buried in Irrigated Soil,
W77-09654 5D

ENERGY RESOURCES CO., INC., CAMBRIDGE, MASS.
Potential Environmental Consequences of Tertiary Oil Recovery,
W77-10023 5C

ENVIRONMENTAL PROTECTION AGENCY. SEATTLE, WASH.
Relationship of Effluent Limitations to Future Pulp Mill Closures,
W77-09727 5D

ENVIRONMENTAL PROTECTION SERVICE, REGINA (SASKATCHEWAN). WATER POLLUTION CONTROL BRANCH.
Water Transport of Wood (In Canada): The Current Situation,
W77-09755 5C

ENVIRONMENTAL RESEARCH LAB., ATHENS, GA. ANALYTICAL CHEMISTRY BRANCH.
A Quantitative Method for Toxaphene by GC-MS Specific Ion Monitoring,
W77-09633 5A

Environmental Applications of Advanced Instrumental Analyses: Assistance Projects, FY 75,
W77-09782 5A

ENVIRONMENTAL RESEARCH LAB., DULUTH, MINN.
Temperature Effects on Young Yellow Perch, Perca Flavescens (Mitchill),
W77-09773 5C

Effects of Aroclor (R) 1254 on Brook Trout, Salvelinus Fontinalis,
W77-09783 5C

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FLA.
The Effect of Mirex on the Burrowing Activity of the Lugworm (Arenicola Cristata),
W77-09675 5C

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC., GAINESVILLE, FLA.
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods,
W77-09759 5D

FISH AND WILDLIFE SERVICE, LA CROSSE, WIS. FISH CONTROL LAB.
Renal Excretion in Channel Catfish Following Injection of Quinaldine Sulphate or 3-trifluoromethyl-4-nitrophenol,
W77-09662 5C

Toxicity of 3-trifluoromethyl-4-nitrophenol (TFM), 2',5-dichloro-4' nitrosalicylanilide (Bayer 73), and a 98:2 Mixture to Fingerlings of Seven Fish Species and to Eggs and Fry of Coho Salmon,
W77-09764 5C

FLORIDA UNIV. BELLE GLADE. DEPT. OF PLANT NUTRITION.
Sulfur-Coated Fertilizers for Sugarcane: I. Plant Response to Sulfur-Coated Urea,
W77-09640 3F

Sulfur-Coated Fertilizers for Sugarcane: II. Release Characteristics of Sulfur-Coated Urea and KC1,
W77-09641 3F

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCE.
Storm Water Management Model: Level I-Comparative Evaluation of Storage-Treatment and Other Management Practices,
W77-09824 5D

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCES.
Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges. Volume II: Cost Assessment and Impacts,
W77-09874 5D

FLORIDA UNIV., GAINESVILLE. ENGINEERING AND INDUSTRIAL EXPERIMENT STATION.
Recycling of Alum Used for Phosphorus Removal in Domestic Waste Water Treatment,
W77-09847 5D

FMC CORP., SANTA CLARA, CALIF. ENVIRONMENTAL ENGINEERING LAB.
Photodynamic Inactivation of Infectious Agents,
W77-09883 5D

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX. WATER RESOURCES DIV.
Annual Water-Resources Review White Sands Missile Range, 1976 - A Basic-Data Report,
W77-10005 4B

GEOLOGICAL SURVEY, BAY SAINT LOUIS, MISS. WATER RESOURCES DIV.
Computation of Records of Streamflow at Control Structures,
W77-10003 2E

GEOLOGICAL SURVEY, CARSON CITY, NEV. WATER RESOURCES DIV.
Water-Resources Appraisal of the Carson River Basin, Western Nevada,
W77-09992 4A

ORGANIZATIONAL INDEX

INDIANA UNIV., BLOOMINGTON. DEPT. OF CHEMISTRY.

GEOLOGICAL SURVEY, CHEYENNE, WYO.
WATER RESOURCES DIV.
 Water Resources Data For Wyoming, Water Year 1975.
 W77-10002 7C

GEOLOGICAL SURVEY, COLUMBUS, OHIO.
WATER RESOURCES DIV.
 Water Resources Data for Ohio, Water Year 1975--Volume 1. Ohio River Basin.
 W77-10000 7C
 Water Resources Data for Ohio, Water Year 1975--Volume 2. St. Lawrence River Basin.
 W77-10001 7C

GEOLOGICAL SURVEY, GRAND FORKS, N. DAK.
 Groundwater Pollution Hazard Near Sanitary Landfills on the Glaciated Plains, North Dakota - A Study of the Langdon, North Dakota Sanitary Landfill,
 W77-09925 5B

GEOLOGICAL SURVEY, HONOLULU, HAWAII. WATER RESOURCES DIV.
 Elements Needed in Design of a Ground-Water-Quality Monitoring Network in the Hawaiian Islands,
 W77-09995 5B

GEOLOGICAL SURVEY, IOWA CITY, IOWA. WATER RESOURCES DIV.
 Geohydrology of Muscatine Island, Muscatine County, Iowa,
 W77-10012 4B

GEOLOGICAL SURVEY, JACKSON, MISS.
WATER RESOURCES DIV.
 The Cockfield Aquifer in Mississippi,
 W77-09991 7C

GEOLOGICAL SURVEY, LAKEWOOD, COLO.
WATER RESOURCES DIV.
 Modeling Chloride Movement in the Alluvial Aquifer at the Rocky Mountain Arsenal, Colorado,
 W77-09994 5B

A Method of Estimating Parameters and Assessing Reliability for Models of Steady State Groundwater Flow 1. Theory and Numerical Properties,
 W77-10008 2F

GEOLOGICAL SURVEY, LAWRENCE, KANS.
WATER RESOURCES DIV.
 Variation of Width and Discharge for Natural High-Gradient Stream Channels,
 W77-10009 2E

GEOLOGICAL SURVEY, LITTLE ROCK, ARK.
WATER RESOURCES DIV.
 Discharge Data at Water-Quality Monitoring Stations in Arkansas, 1976 Water Year,
 W77-09997 7C

GEOLOGICAL SURVEY, LOUISVILLE, KY.
WATER RESOURCES DIV.
 Ground-Water Resources of the Lexington, Kentucky, Area,
 W77-09996 4B

GEOLOGICAL SURVEY, NASHVILLE, TENN.
WATER RESOURCES DIV.
 Application of the U.S. Geological Survey Rainfall Runoff Simulation Model to Improve Flood-Frequency Estimates on Small Tennessee Streams,
 W77-10004 2A

GEOLOGICAL SURVEY, OKLAHOMA CITY, OKLA. WATER RESOURCES DIV.
 Selected Water-Level Records for Western Oklahoma, 1975-1976,
 W77-09998 7C

Ground-Water Levels in Observation Wells in Oklahoma, 1975,
 W77-09999 7C

GEOLOGICAL SURVEY, PORTLAND, OREG.
WATER RESOURCES DIV.
 Water Resources of the Umatilla Indian Reservation, Oregon,
 W77-10011 4A
 1976 Water-Quality Data in Bear Creek Basin, Medford, Oregon,
 W77-10015 5A

GEOLOGICAL SURVEY, RESTON, VA.
WATER RESOURCES DIV.
 Computation of Unsteady Flows in Rivers and Estuaries by the Method of Characteristics,
 W77-09993 2E

Water Quality Program of the U.S. Geological Survey,
 W77-10006 5A

Federal Plan for Acquisition of Water Data by Federal Agencies, Fiscal Year 1977.
 W77-10013 7C

GEOLOGICAL SURVEY, RESTON, VA.
WATER RESOURCES DIV.; AND GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE, SUFFOLK, VA.; AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.

The Great Dismal Swamp: Management of a Hydrologic Resource with the Aid of Remote Sensing,
 W77-10007 2H

GEOLOGICAL SURVEY, TALLAHASSEE, FLA.
WATER RESOURCES DIV.
 Fluctuations of Ground-Water Levels in Lee County, Florida, In 1975 Water Year,
 W77-10014 2F

GOSUDARSTVENNYI NAUCHNO-ISSEDOVATELSKII INSTITUT OZERNOGO I RECHNOGO RYBNOGO KHOZYAISTVA, VOLGOGRAD (USSR).

Ecology of the Azov Vimba, Vimba Vimba Carinata (Pall.), of the Tsimlyansk Reservoir, (In Russian),
 W77-09610 2H

GULF COAST RESEARCH LAB., OCEAN SPRINGS, MISS.

Mesenchymal Tumors of Some Estuarine Fishes in the Northern Gulf of Mexico. II. Subcutaneous Fibromas in the Southern Flounder, Paralichthys lethostigma, and the Sea Catfish, Arius felis,
 W77-09780 5C

HARYANA AGRICULTURAL UNIV., HISSAR (INDIA). DEPT. OF SOILS.
 Phosphorus-Zinc Interaction in Relation to Absorption Rates of Phosphorus, Zinc, Copper, Manganese, and Iron in Corn,
 W77-09656 3F

HAWAII INST. OF GEOPHYSICS, HONOLULU.
 Uranium Oxidation and Probable Subaerial Weathering of Phosphatized Limestone from the Pourtales Terrace,
 W77-09951 2J

HAWAII UNIV., HONOLULU. DEPT. OF SOIL SCIENCE.
 Changes in the Physical Properties of Soil Clays Due to Precipitated Aluminum and Iron Hydroxides: II. Colloidal Interactions in the Absence of Drying,
 W77-09975 2G

HELSINKI UNIV. (FINLAND). DEPT. OF GEOPHYSICS.
 Estimating the Water and Salt Budgets of a Stratified Estuary,
 W77-09709 2L

HELSINKI UNIV. (FINLAND). DEPT. OF METEOROLOGY.
 Experiences with the Use of the Aerological Method in Evaporation Studies in Northwestern Europe,
 W77-09710 2D

HOUSTON UNIV., TEX. DEPT. OF CIVIL ENGINEERING.
 Computer Application in Water and Waste Water Management: A Panel Discussion,
 W77-09903 5D

HYDROSCIENCE, INC., KNOXVILLE, TENN.
 How Sludge Characteristics Affect Incinerator Design,
 W77-09869 5E

IDAHO UNIV., MOSCOW. COLL. OF FORESTRY, WILDLIFE AND RANGE SCIENCES.
 The Effects of Granitic Sand on the Distribution and Abundance of Salmonids in Idaho Streams,
 W77-09797 2I

ILLINOIS STATE WATER SURVEY, URBANA. HYDROLOGY SECTION.
 Water Supply from Shelbyville and Carlyle Lakes and Their Optimal Joint Operation,
 W77-09943 4A

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
 Evaluation of a Laboratory Microcosm for Study of Toxic Substances in the Environment: Final Technical Report, July 1, 1973-December 31, 1975,
 W77-09769 5A

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
 Gas Stripping, Sorption, and Thermal Desorption Procedures for Preconcentrating Volatile Polar Water-Soluble Organics from Water Samples for Analysis by Gas Chromatography,
 W77-09746 5A

Organic Matter Removal by Powdered Activated Carbon Added to Activated Sludge,
 W77-09850 5D

Buoyant Surface Jets Discharged into a Strong Crossflow,
 W77-09926 5B

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. SCHOOL OF CHEMICAL SCIENCES.
 Automated Catalytic Ultramicrodetermination of Manganese in Natural Waters with a Miniature Centrifugal Analyzer,
 W77-09753 2K

INDIANA UNIV., BLOOMINGTON. DEPT. OF CHEMISTRY.
 Carbon Isotopic Study of the Fate of Landfill Leachate in Groundwater,
 W77-09917 5B

ORGANIZATIONAL INDEX

INDIANA UNIV., BLOOMINGTON. DEPT. OF CHEMISTRY.

INSTITUT OCEANOGRAPHIQUE, PARIS

(FRANCE). LABORATOIRE DE PHYSIOLOGIE DES ETRES MARINS.

Effect of Organic Excretion by Benthic Annelida on the Productivity of Phytoplankton, W77-09660 5C

INSTITUT RUDJER BOSKOVIC, ROVINJ (YUGOSLAVIA). CENTER FOR MARINE RESEARCH.

Note on the Effects of Lead on Oxygen Production of Several Littoral Seaweeds of the Adriatic Sea, W77-09682 5C

INSTITUTE OF HYDROLOGY, OXON (ENGLAND).

A Model of Transpiration and Interception Loss from a Spruce Forest in Plynlimon, Central Wales, W77-09711 2D

INSTITUTE OF OCEANOGRAPHIC SCIENCES, BIRKENHEAD (ENGLAND).

A Model of the Annual Cycle of Temperature in a Frontal Region of the Celtic Sea, W77-09708 2L

INSTITUTE OF OCEANOGRAPHIC SCIENCES, WORMLEY (ENGLAND).

The Bottom Mixed Layer on the Continental Shelf, W77-09948 2L

INSTITUTES OF MEDICAL SCIENCES, SAN FRANCISCO, CALIF. (ASSIGNEE).

Acoustical Wave Flowmeter, W77-09809 7B

INSTITUTO NACIONAL DE PESCA, MEXICO CITY.

Partial Analysis of the Microplankton in the Lagoon of Pueblo Viejo, State of Vera Cruz, Mexico, (In Spanish), W77-10066 2L

INSTYTUT INZYNIERII OCHRONY

ŚRODOWISKA POLITECHNIKI ŚLĄSKIEJ, FŁIWICE (POLAND).

Application of Reverse Osmosis and Ultrafiltration to the Purification of Pulp and Paper Industry Effluents (Zastosowanie odwroconej osmozy i ultrafiltracji do oczyszczania ścieków z przemysłu celulozowo-papierniczego), W77-09733 5D

INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTRE, LONDRES (MEXICO).

Crop Temperature Modification and Yield Potential in a Dwarf Spring Wheat, W77-09939 3F

IOWA STATE CONSERVATION COMMISSION, DES MOINES. FISHERIES SECTION.

Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors, W77-09768 5C

IRKUTSKII GOSUDARSTVENNYI

UNIVERSITET (USSR). LAKE BAIKAL BIOLOGICAL STATION.

The Ecology of Chydoridae (Cladocera) of Lake Baikal (In Russian), W77-10064 2H

ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LTD., HAIFA.

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-09742 5A

JOHANNESBURG CITY COUNCIL (SOUTH AFRICA).

Controlling the Access of Nutrients from Point and Diffused Sources with Special Reference to the Pretoria/Witwatersrand/Vereeniging Region, W77-10082 5G

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF EARTH AND PLANETARY SCIENCES; AND JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF MECHANICS AND MATERIALS SCIENCE.

Three-Layer Circulations in Estuaries and Harbors, W77-09723 2L

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF MECHANICS AND MATERIALS SCIENCE; AND JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF EARTH AND PLANETARY SCIENCES.

Three-Layer Circulations in Estuaries and Harbors, W77-10030 2L

KANSAS DEPT. OF HEALTH AND ENVIRONMENT, TOPEKA.

Accommodation of Daphnia pulex to Altered pH Conditions as Measured by Feeding Rate, W77-09678 5C

KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRONOMY.

Evaluation of an Evapotranspiration Model for Corn, W77-09941 2D

KANSAS STATE UNIV., MANHATTAN. DEPT. OF GEOLOGY.

Geochemical Controls on Trace Element Concentrations in Natural Waters of a Proposed Coal Ash Landfill Site, W77-09928 5B

KANSAS UNIV., LAWRENCE. DEPT. OF GEOLOGY; AND KANSAS UNIV., LAWRENCE. MUSEUM OF INVERTEBRATE PALEONTOLOGY.

Analysis of Data from Biological Surveys of Streams: Diversity and Sample Size, W77-09778 5A

KAZAKH RESEARCH INST. OF FISHERIES, BALKHASH (USSR).

Characteristics of the Zooplankton of the Lower Reaches of the Irgiz and Turgay Rivers, (In Russian), W77-09940 5C

KEELE UNIV. (ENGLAND). DEPT. OF GEOLOGY.

Deep Distributary Channels and Giant Bedforms in the Upper Carboniferous of the Central Pennines, Northern England, W77-09700 2J

KENNEDY ENGINEERS, INC., SAN FRANCISCO, CALIF.

Low Cost Phosphorus Removal at Reno Sparks, Nevada, W77-09849 5D

KLAMATH NATIONAL FOREST YREKA, CALIF.

Cation-Exchange Capacity of Acid Soils Using Aluminum Chloride and Barium Chloride-Triethanolamine, W77-09652 2G

LAKE COUNTY MOSQUITO ABATEMENT DISTRICT, LAKEPORT, CALIF.

Biological Effects and Persistence of Methyl Parathion in Clear Lake, California, W77-10063 5C

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, N.Y.

North Atlantic Ice-Rafting: A Major Change at 75,000 Years Before the Present, W77-09706 2J

LEHIGH UNIV., BETHLEHEM, PA. CENTER FOR SURFACE AND COATINGS RESEARCH.

Ice Nucleation by Micas, W77-09956 2B

LIEGE UNIV. (BELGIUM). DEPT. OF BOTANY.

A Practical Apparatus for Quantitative Sampling of Epilithic Periphyton, (In French), W77-09623 7B

LIFE SYSTEMS, INC., CLEVELAND, OHIO.

Research and Development of an Electrochemical Biocide, Final Report, W77-09771 5D

LION FAT AND OIL CO., LTD., TOKYO (JAPAN). (ASSIGNEE).

Method of Treating Waste Water Containing Surfactant and Heavy Metals, W77-09815 5D

LOS ALAMOS SCIENTIFIC LAB., N. MEX.

Distribution of Plutonium in Trinity Soils After 28 Years, W77-09647 5B

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.

Current Dynamics and Sediment Distribution in the West Mississippi Delta Area, W77-10032 2L

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF AGRONOMY.

Nitrite Decomposition in Flooded Soil Under Different PH and Redox Potential Conditions, W77-09645 2G

Ammonium Diffusion as a Factor in Nitrogen Loss from Flooded Soils, W77-09966 5B

LOVE (L. S.) ASSOCIATES LTD., BRAMPTON (ONTARIO). (ASSIGNEE).

Gravitational Separator, W77-09821 5D

MACDONALD COLL., STE. ANNE DE BELLEVUE (QUEBEC). DEPT. OF MICROBIOLOGY.

Nitrogen Fixation in Arctic Marine Sediments: Effect of Oil and Hydrocarbon Fractions, W77-09676 5B

MANCHESTER POLYTECHNIC (ENGLAND). DEPT. OF CHEMISTRY AND BIOLOGY.

The Effect of Copper on Competition Between Marine Algae, W77-10051 5C

ORGANIZATIONAL INDEX

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.

Petroleum Hydrocarbons: Degradation and Growth Potential of Deep-Sea Sediment Bacteria, W77-09772 5C

MARYLAND UNIV., COLLEGE PARK. INLAND ENVIRONMENTAL LAB.

Immediate Behavioral Reactions of Blacknose Dace, *Rhinichthys atratulus*, to Domestic Sewage and its Toxic Constituents, W77-09669 5C

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CHEMISTRY.

Determination of Nitrilotriacetate in Environmental Water by Gas Chromatography of the Trimethylsilyl Ester, W77-09751 5A

MASSACHUSETTS UNIV., AMHERST.

Evaluation of Process Design Parameters for Phosphorus Removal from Domestic Waste Waters by Chemical Clarification, W77-09602 5D

MASSACHUSETTS WATER RESOURCES COMMISSION, WESTBOROUGH. WATER QUALITY SECTION.

Determining Photosynthetic Productivity in Streams, W77-10080 5C

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF CHEMICAL ENGINEERING.

Activated Carbon Adsorption Process for Purification of Textile Waste Waters, W77-09744 5D

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CHEMICAL ENGINEERING.

Nitrogen Control: Design Considerations for Supported Growth Systems, W77-09848 5D

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF BIOLOGY.

Plankton Ecology in Long Pond, St. Johns, Newfoundland: A Polluted Pond Characterized by a High Flushing Rate, W77-09664 5C

METCALF AND EDDY, INC., NEW YORK.

Reduction and Recovery: Keys to Energy Self-Sufficiency, W77-09877 5D

MIAMI UNIV., FLA.

A DSC (Differential Scanning Calorimetry) Study of Heat Capacity of Vicinal Water in Porous Materials, W77-09734 1B

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF FISHERIES AND WILDLIFE.

The Freshwater Mussel (*Anodonta* sp.) as an Indicator of Environmental Levels of 3-Trifluoromethyl-4-Nitrophenol (TFM), W77-09765 5C

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF ZOOLOGY.

Filtering Rate Inhibition of *Daphnia pulex* in Wintgreen Lake Water, W77-09910 5C

MICHIGAN UNIV., ANN ARBOR. DEPT. OF CIVIL ENGINEERING.

A Food Web Model for Lake Michigan: Part I-Justification and Development of the Model, W77-09631 5C

MICHIGAN UNIV., ANN ARBOR. DEPT. OF METEOROLOGY AND OCEANOGRAPHY.

Underwater Habitats for Scientific Research in the Great Lakes, W77-10060 7B

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.

Biological, Chemical and Physical Relationships in the Straits of Mackinac, W77-10058 5C

MIDWEST RESEARCH INST., KANSAS CITY, MO.

Loading Functions for Assessment of Water Pollution from Nonpoint Sources, W77-09726 5B

MIEKEN SCIENCE EDUCATION CENTER, YOKKAICHI (JAPAN).

Studies on the Bottom Fauna of Four Lakes in Eastern Hokkaido (Lakes Kusshyaro-Ko, Akan-Ko, Toro-Ko and Shikaribetsu Ko, (In Japanese), W77-10028 5C

MILITARY ENGINEERING SERVICES, CHANDIGARH (INDIA).

Chemical Treatment of Sewage, W77-09892 5D

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF SOIL SCIENCE.

Calcium and Strontium Absorption by Corn Roots in the Presence of Chelates, W77-09657 3F

MINNESOTA UNIV., ST. PAUL. DEPT. OF ENTOMOLOGY, FISHERIES AND WILDLIFE.

Toxicity of Hydrogen Sulfide to Various Life History Stages of Bluegill (*Lepomis macrochirus*), W77-09668 5C

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF CHEMICAL ENGINEERING.

Concurrent Waste Water Renovation and Solid Waste Composting, W77-09879 5D

MISSOURI UNIV.-COLUMBIA.

Character and Dewatering Properties of Sludges from Water Treatment, W77-09881 5D

MONSANTO CO., ST. LOUIS, MO. (ASSIGNEE).

Detoxification of Aqueous Waste Streams Containing Cyanide, W77-09812 5D

MONTGOMERY (JAMES M.), INC., BOISE, IDAHO.

Forest Harvest, Residue Treatment, Reforestation, and Protection of Water Quality, W77-09756 5G

MOSCOW STATE UNIV. (USSR).

Scientific Bases of a System for Averting Unfavorable Consequences of Steppe Soil Irrigation, (In Russian), W77-10021 2G

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OHIO. WASTEWATER RESEARCH DIV.

Urban Runoff Pollution Control-Technology Overview, W77-09823 5D

MUNICIPAL WATER WORKS OF ROTTERDAM (NETHERLANDS).

Chlorination Reactions of Fulvic Acids in Natural Waters, W77-09741 5F

NATAL UNIV., DURBAN (SOUTH AFRICA).

Wisselwerking tussen land en see, of, die ekologie van die kuswaters van Natal (The Inter-action between Land and Sea, or, the Ecology of the Coastal Waters of Natal), W77-10072 2L

NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA). DEPT. OF AGRICULTURAL ENGINEERING.

On the Application of Trend Surfaces of Precipitation to Mountainous Areas, W77-10088 2B

NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA). DEPT. OF FORESTRY.

Grassing Roads and Eroded Areas in the Drakensberg, W77-10075 4D

NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C. COMMISSION ON INTERNATIONAL RELATIONS.

Arid Lands of Sub-Saharan Africa, W77-09934 6E

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT. GODDARD SPACE FLIGHT CENTER.

Satellite-Derived Global Oceanic Rainfall Atlas (1973 and 1974), W77-09693 7C

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR (INDIA).

Waste Water Treatment by Anaerobic Contact Filter, W77-09862 5D

Evaluation of Cellulose Acetate Membranes for Reverse Osmosis Separation, W77-09863 5D

Productivity of *Clarias* *Batrachus* in the Sewage Fertilized Fish Ponds, W77-09922 5C

NATIONAL ENVIRONMENTAL RESEARCH CENTER, CINCINNATI, OHIO. ADVANCED WASTE TREATMENT RESEARCH LAB.

Problems and Solutions for Sludge Treatment. Part 2, W77-09829 5D

NATIONAL INST. FOR WATER RESEARCH, PRETORIA, (SOUTH AFRICA).

The Renovation and Re-Use of Wastewater, W77-09686 5D

Parameters which Influence the Organic Carbon Determination in Water, W77-10092 5A

Microcystis Toxins: Isolation, Identification, Implications, W77-10093 5A

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES CENTER.

Induction of Hepatic Aryl Hydrocarbon Hydroxylase in Salmon Exposed to Petroleum Dissolved in Seawater and to Petroleum and Polychlorinated Biphenyls, Separate and Together, in Food, W77-09683 5C

ORGANIZATIONAL INDEX

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES

NATIONAL MARINE FISHERIES SERVICE, WEST BOOTHBAY HARBOR, MAINE. BIOLOGICAL LAB.

Supersaturation of Atmospheric Gases in the
Coastal Waters of the Gulf of Maine,
W77-09793 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MICH. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.

Environmental Status of the Lake Michigan
Region: Vol. 4. Phytoplankton of Lake
Michigan,
W77-10056 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FLA. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.

Steroids as Sewage Specific Indicators in New
York Bight Sediments,
W77-09901 5A

NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA.

Weather Modification Effects and Management
(A Bibliography with Abstracts),
W77-09694 2B

NATIONAL WATER QUALITY LAB., DULUTH, MINN.

Thermal Tolerance of Two Species of Gam-
marus,
W77-09730 5C

NAVAL ACADEMY, ANNAPOLIS, MD. DEPT. OF NAVAL SYSTEMS ENGINEERING.

Simulation Factors Involved in Ocean Thermal
Power Plants,
W77-10034 5B

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF CHEMISTRY.

Determination of Molybdenum in Seawater by
Electron Paramagnetic Resonance Spec-
trometry,
W77-09750 2K

NEW HAMPSHIRE UNIV., DURHAM. INST OF NATURAL AND ENVIRONMENTAL RESOURCES.

Computer Simulation of Phosphorus Movement
Through Soils,
W77-09970 5B

NEW JERSEY INST. OF TECH., NEWARK.

Land Application of Municipal Sludge,
W77-09882 5E

NEW MEXICO AGRICULTURAL EXPERIMENT STATION, UNIVERSITY PARK.

Predicting 2,4,5-T Movement in Soil Columns,
W77-09649 5B

NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF GEOLOGY.

Short Term Sedimentation Response in Lakes
in Western United States as Measured by Auto-
mated Sampling,
W77-09701 2J

NEW YORK STATE DEPT. OF HEALTH, ALBANY. ENVIRONMENTAL HEALTH CENTER.

Restoration of Lower St. Regis Lake (Franklin
County, New York),
W77-10054 5C

NOONAN (R.S.), INC. OF SOUTH CAROLINA, GREENVILLE.

Treatment of Denim Textile Mill Wastewaters:
Neutralization and Color Removal,
W77-09724 5D

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF CIVIL ENGINEERING.

A Dynamic Water Quality Model for the Neuse
Estuary, N.C.,
W77-10037 5B

NORTH CAROLINA STATE UNIV., RALEIGH. SEA GRANT PROGRAM.

Animal Colonization of Man-Initiated Salt
Marshes on Dredge Spoil,
W77-10035 2L

NORTHERN IRELAND DEPT. OF AGRICULTURE, ANTRIM. FRESHWATER BIOLOGICAL INVESTIGATION UNIT.

Domestic and Agricultural Contributions to the
Inputs of Phosphorus and Nitrogen to Lough
Neagh,
W77-09722 5B

NORTHWESTERN UNIV., EVANSTON, ILL. DEPT. OF INDUSTRIAL ENGINEERING.

Optimal Operation of Flood Control Systems,
(Final Report; V.II),
W77-09927 4A

NORWEGIAN INST. OF SEAWEED RESEARCH, TRONDHEIM.

Heavy Metal Tolerance of Marine Phytoplank-
ton. II. Copper Tolerance of Three Species in
Dialysis and Batch Cultures,
W77-09781 5C

NOTRE DAME UNIV., IND.

Studies on the Reclamation of Stone Lake,
Michigan,
W77-09605 5G

OAK RIDGE NATIONAL LAB., TENN.

Nitrogen, Phosphorus, and Potassium Utiliza-
tion in the Plant-Soil System: An Analytical
Model,
W77-09964 2I

Extraction of Soil Water Using Cellulose-
Acetate Hollow Fibers,
W77-09967 2G

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER.

Release of Cadmium from Clays and Plant Up-
take of Cadmium from Soil as Affected by
Potassium and Calcium Amendments,
W77-09962 2G

Microbial Inorganic Polyphosphates: Factors
Influencing Their Accumulation,
W77-09965 2G

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER. DEPT. OF AGRONOMY AND AGRICULTURAL ENGINEERING.

Influence of Long Term Tillage, Crop Rotation,
and Soil Type Combinations on Corn Yield,
W77-09969 3F

OKLAHOMA STATE UNIV., STILLWATER. BIOENVIRONMENTAL ENGINEERING LABS.

Chemically Assisted Biological Oxidation of
Wastes and Excess Sludge,
W77-09871 5D

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.

Growth of Tulips Treated with Sludge Contain-
ing Dewatering Chemicals,
W77-09867 5E

Elemental Composition of Sludge-Fertilized
Chrysanthemums,
W77-09868 5E

OKLAHOMA UNIV. HEALTH SCIENCES CENTER, OKLAHOMA CITY.

Rapid Sand Filtration for Best Practical Treat-
ment of Domestic Waste Water Stabilization
Pond Effluent,
W77-09853 5D

OKLAHOMA UNIV., NORMAN. SCHOOL OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE.

Water Reuse in a Paper Reprocessing Plant,
W77-09757 5D

ONTARIO MINISTRY OF THE ENVIRONMENT, REXDALE. LAB. SERVICE BRANCH.

Determination of Free and Total Potential
Haloforms in Drinking Water,
W77-09748 5A

ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA). DEPT. OF NATURE CONSERVATION.

Waterfowl (Anatidae) on Irrigation Lakes in the
Orange Free State,
W77-10097 2H

OREGON STATE UNIV., CORVALLIS. DEPT. OF AGRICULTURAL ENGINEERING.

Application of the Rotating Flighted Cylinder
to Livestock Waste Management,
W77-09795 5D

OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEANOGRAPHY.

The Causes of Erosion to Siletz Spit, Oregon,
W77-10039 2L

OREGON STATE UNIV., CORVALLIS. SCHOOL OF OCEANOGRAPHY.

Seasonal Variation in Temperature, Salinity,
and Density Over the Continental Shelf Off
Oregon,
W77-09703 2L

ORGANON DIAGNOSTICS, EL MONTE, CALIF.

Water System Virus Detection,
W77-09636 5A

OTTAWA UNIV. (ONTARIO). DEPT. OF BIOLOGY.

Competition for Mercury Between River Sedi-
ment and Bacteria,
W77-09661 5B

OXFORD UNIV. (ENGLAND). DEPT. OF GEOLOGY AND MINERALOGY.

Shallow Marine Sand Bar Sequences: An Ex-
ample from the Late Precambrian of North
Norway,
W77-09699 2J

PACKARD AND ANDERSON ENGINEERS, AUBURN, N. Y.

Impact of Municipal Water and Sewage
Charges on Industry,
W77-09921 5G

ORGANIZATIONAL INDEX

SOUTH BEND BUREAU OF WASTEWATER, IND.

PENNSYLVANIA STATE UNIV., WILKES-BARRS. DEPT. OF BIOLOGY.

Temperature as a Proximate Factor in Orientation Behavior,
W77-09680 5C

PENNSYLVANIA UNIV., PHILADELPHIA. COLL. OF ENGINEERING AND APPLIED SCIENCE.

Fermentation Technology,
W77-09896 5D

PERKIN-ELMER CORP., LOMBARD, ILL.

Atomic Absorption in Water and Waste Water Analysis,
W77-09909 5A

PERMUTIT CO., PARAMUS, N. J.

Application of Membrane Processes,
W77-09929 3A

PETROLITE CORP., ST. LOUIS, MO.

TRETOLITE DIV.

Polymer Addition Improves Waste Water Treatment Process,
W77-09878 5D

PRAIRIE VIEW A AND M COLL., TEX.

Effect of Pretreatment on Loss of Nitrogen-15-Labelled Fertilizer Nitrogen from Waterlogged Soil During Incubation,
W77-09643 2G

PUBLIC WORKS RESEARCH INST., TOKYO (JAPAN).

A Mathematical Model for Water Quality in a Coastal Region in Terms of Sea Bottom Waste Deposits (Kaitei osenbusshitsu nado no eikyo o koryo shita kaiiki no suishitsu no yosokumoderu no kaiatsu ni kansuru kenkyu),
W77-09911 5B

PURDUE UNIV., LAFAYETTE, IND. DEPT. OF AGRONOMY.

Chemical Composition of Sewage Sludges and Analysis of Their Potential Use as Fertilizers,
W77-09904 5A

QUEENSLAND WHEAT RESEARCH INST., TOOWOOMBA (AUSTRALIA). PRIMARY INDUSTRIES DEPT.

The Nature of Changes in Bulk Density with Water Contents in Cracking Clay,
W77-09937 2G

RANDSE AFRIKAANSE UNIVERSITEIT, JOHANNESBURG (SOUTH AFRICA). DEPT. OF ZOOLOGY.

The Effect of Tricain Methanesulphonate (MS-222) on the Microhaematocrit of Fish Blood,
W77-09665 5C

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N.C.

Estimation of Permissible Concentrations of Pollutants for Continuous Exposure,
W77-09788 5A

RESOURCE PLANNING ASSOCIATES, CAMBRIDGE, MASS.

Identification and Analysis of Mid-Atlantic Onshore OCS Impacts,
W77-10027 5C

RHODE ISLAND UNIV., KINGSTON. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.

An Electric Analog and Digital Computer Model of the Chipuxet Ground Water Aquifer, Kingston, Rhode Island,
W77-09637 2F

RHODES UNIV., GRAHAMSTOWN (SOUTH AFRICA) INST. OF FRESHWATER STUDIES.

Lake Sibaya - A Land-Locked Estuary,
W77-10099 2H

RHODES UNIV. (SALISBURY). DEPT. OF ZOOLOGY.

The Darwendale Reservoir as a Fishery,
W77-10096 2H

RHODESIA UNIV., SALISBURY. DEPT. OF MEDICAL MICROBIOLOGY.

Observations on the Intestinal Protozoa Infecting Man in Rhodesia,
W77-09691 5F

Protozoan and Helminthic Infections of the Intestines of Humans in the Inyanga Area of Rhodesia,
W77-10076 5G

RHODESIA UNIV., SALISBURY. DEPT. OF ZOOLOGY.

The Physico-Chemical Limnology of the Mwenda River Mouth, Lake Kariba,
W77-09614 5C

ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OKLA.

Acute Toxic Effects of Petroleum Refinery Wastewaters on Redear Sunfish,
W77-09786 5C

Comparison of Five Kinetic Models for Orthophosphate Reactions in Mineral Soils,
W77-09968 2G

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.

The Toxicity of Malathion and Its Hydrolysis Products to the Eastern Mudminnow, Umbra pygmaea (DeKay),
W77-09670 5C

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. DEPT. OF ENVIRONMENTAL SCIENCE.

Nitrification in a Chlorinated Activated Sludge Culture,
W77-09851 5D

SAINT MARY'S UNIV., HALIFAX (NOVA SCOTIA). DEPT. OF CHEMISTRY.

Using O(xygen) D(emand) I(ndex), COD, and BOD Tests to Characterize Kraft Mill Effluent,
W77-09729 5A

SALA MAGNETICS, INC., CAMBRIDGE, MASS.

Treatment of Combined Sewer Overflows by High Gradient Magnetic Separation,
W77-09825 5D

SAN DIEGO UNIV., CALIF. DEPT. OF BIOLOGY.

The Origin and Structure of American Arid-Zone Ecosystems. The producers: Interactions Between Environment, Form and Function,
W77-09933 2A

SANDIA LABS., ALBUQUERQUE, N. MEX.

Inactivation by Ionizing Radiation of Salmonella Enteritidis Serotype Montevideo Grown in Composted Sewage Sludge,
W77-09880 5D

Identification of the Virucidal Agent in Waste Water Sludge,
W77-09897 5A

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.

Determination of Arsenic Species in Natural Waters,
W77-09747 5A

SEELYE, STEVENSON, VALUE, AND KNECHT, NEW YORK.

Two-Stage Settling Improves Sludge Removal Efficiency,
W77-09875 5D

SIBERIAN RESEARCH INST. OF THE FISH INDUSTRY, SVERDLOVSK (USSR). URAL DIV.

Urceolarids (Ciliata, Peritricha) from Fishes of the Urals, (In Russian),
W77-09936 2H

SIEMENS (PTY) LTD., CAPE TOWN (SOUTH AFRICA).

Cape Town's Steenbras Hydro-Electric Pumped Storage Scheme,
W77-10071 8A

SIR VENKATESWARA UNIV., TIRUPATI (INDIA). DEPT. OF CIVIL ENGINEERING.

An Approach to Reduce Water Consumption in Neighborhoods Through Reuse,
W77-09855 5D

SKIDAWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.

Report on a Biologic and Sedimentologic Study Related to the Tybee Island Beach Nourishment Project and the Offshore Area for Dredge Material Disposal,
W77-10029 2L

SKIDWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.

Geochemical Interactions of Heavy Metals in Southeastern Salt Marsh Environments,
W77-09767 5B

SOILS AND IRRIGATION RESEARCH INST., PRETORIA (SOUTH AFRICA).

Irrigation Requirements of Mature Peach Trees Under Microjets (Besproeiingsbehoefte van volwasse perskebome onder mikrospruite),
W77-10079 3F

SOUTH AFRICA UNIV., PRETORIA. DEPT. OF GEOGRAPHY.

Rainfall Trends in 80 Rainfall Districts of South Africa,
W77-10085 2B

SOUTH AFRICAN DEPT. OF WATER AFFAIRS, PRETORIA. DIV. OF HYDROLOGY.

Small Catchment Flood Modelling,
W77-10083 2E

SOUTH AFRICAN DIV. OF NATURE CONSERVATION AND TOURISM, ETOSHA. ECOLOGICAL INST.

A Check List and Notes on the Birds of Sandvis, South West Africa,
W77-10089 2L

SOUTH AFRICAN MEDICAL RESEARCH COUNCIL, POTCHEFSTROOM.

The Tugela-Vaal State Water Scheme as a Bilharzia Risk (Die Tugela-Vaal-Staatswaterskema as 'n Bilharziarisiko),
W77-09620 5G

SOUTH BEND BUREAU OF WASTEWATER, IND.

South Bend's Industrial Surveillance Waste Water Monitoring Program,
W77-09919 5A

ORGANIZATIONAL INDEX

SOUTH BEND BUREAU OF WASTEWATER, IND.

SOUTH WEST AFRICAN CONSOLIDATED
DIAMOND MINES LTD., ORANJEMUND.
A Unique Means of Obtaining Sea-Water,
W77-09692 8E

SOUTHWEST RESEARCH INST., HOUSTON,
TEX.
A Simple Hand Corer for Shallow Water Sam-
pling,
W77-09715 7B

STANLEY ASSOCIATES ENGINEERING, LTD.,
EDMONTON (ALBERTA).
Analysis of Economic Sewage Lift Station
Design,
W77-09906 8C

STATE UNIV. OF NEW YORK AT STONY
BROOK. DEPT. OF EARTH AND SPACE
SCIENCES.
Sedimentation Rates in a Coastal Marsh Deter-
mined from Historical Records,
W77-09713 2J

STATE UNIV. OF NEW YORK AT STONY
BROOK. MARINE SCIENCES RESEARCH
CENTER.
A Model of Dynamics in the Lower Potomac
River Estuary,
W77-09714 2L

STATE UNIV. OF NEW YORK COLL. AT
BUFFALO. GREAT LAKES LAB.
An Investigation of the Nearshore Region of
Lake Ontario IFYGL.
W77-10053 5C

STRATHMORE PAPER CO., TURNERS FALLS,
MASS.
Paper Mill Wastewater Treatment by Micros-
training,
W77-09758 5D

SWEDISH FOREST PRODUCTS RESEARCH
LAB., STOCKHOLM.
Characterization of Spent Bleaching Liquors.
Part 1, Spent Liquors from the Chlorine and
Alkali Extraction Stages in the Prebleaching of
Pine Kraft Pulp,
W77-09731 5A

SYDNEY UNIV. (AUSTRALIA). DEPT. OF
GEOGRAPHY.
Sediment Transport and Deposition at River
Mouths: A Synthesis,
W77-09705 2J

SYRACUSE RESEARCH CORP., N.Y. CENTER
FOR CHEMICAL HAZARD ASSESSMENT.
Investigation of Selected Potential Environ-
mental Contaminants: Ketonic Solvents,
W77-09770 5B

SYRACUSE UNIV., N. Y.
Some Effects of Lime Addition on High Solids,
Completely Mixed, Activated Sludge Waste
Water Treatment,
W77-09601 5D

TECHNICAL UNIV. OF DENMARK, LYNGBY.
INST. OF HYDRODYNAMICS AND
HYDRAULIC ENGINEERING.
Return Periods of Hydrological Events,
W77-09958 2B

TECHNISCHE UNIVERSITAET, BERLIN
(WEST GERMANY). INST. OF ECOLOGY.
Intensive Large City Influence on Reed-Banks,
(In German),
W77-09621 5C

TENNESSEE STATE UNIV., NASHVILLE.
Growth Responses of Chicks Fed Microbial
Protein Produced from Organic Wastes,
W77-09785 5C

TENNESSEE UNIV., KNOXVILLE. DEPT. OF
PLANT AND SOIL SCIENCE; AND TENNESSEE
UNIV., KNOXVILLE. AGRICULTURAL
EXPERIMENT STATION.
Chemical Distribution and Gaseous Evolution
of Arsenic-74 Added to Soils as DSMA-(74)AS,
W77-09659 5B

TETRA TECH., INC., LAFAYETTE, CALIF.
A Guide to Aeration/Circulation Techniques
for Lake Management,
W77-09603 5G

TEXAS A AND M UNIV., COLLEGE STATION.
DEPT. OF BIOLOGY.
Wastewater Microbiology,
W77-09893 5D

TEXAS A AND M UNIV., COLLEGE STATION.
DEPT. OF SOIL MINERALOGY.
Potassium Sources and Availability on a Deep,
Sandy Soil of East Texas,
W77-09972 2G

TEXAS A AND M UNIV., CORPUS CHRISTI.
AGRICULTURAL RESEARCH AND
EXTENSION CENTER.
Ammonia Volatilization and Nitrogen Utiliza-
tion from Sulfur-Coated Ureas and Conven-
tional Nitrogen Fertilizers,
W77-09642 3F

TEXAS A AND M UNIV., EL PASO.
AGRICULTURAL RESEARCH STATION.
Ammonia Volatilization from Surface Applica-
tions of Ammonium Compounds on Calcareous
Soils: V. Soil Water Content and Method of
Nitrogen Application,
W77-09960 2G

The Influence of Cation Exchange Capacity
and Depth of Incorporation on Ammonia
Volatilization from Ammonium Compounds
Applied to Calcareous Soils,
W77-09961 2G

TEXAS UNIV. AT AUSTIN. CENTER FOR
RESEARCH IN WATER RESOURCES.
Methodology to Evaluate Alternative Coastal
Zone Management Policies: Application in the
Texas Coastal Zone, Special Report III: A
Methodology for Investigating Fresh Water In-
flow Requirements of a Texas Estuary, Vol I,
W77-10022 2L

TEXAS UNIV. AT AUSTIN. PORT ARANSAS.
MARINE SCIENCE INST.
Hydraulics and Dynamics of New Corpus
Christi Pass, Texas: A Case History, 1973-75,
W77-09982 2L

TEXAS UNIV. AT DALLAS, RICHARDSON.
CENTER FOR ENVIRONMENTAL STUDIES.
Algal Nutrient Availability and Limitation in
Lake Ontario During IFGYL. Part 1, Available
Phosphorus in Urban Runoff and Lake Ontario
Tributary Waters,
W77-10052 5C

THERMO-KINETICS, INC., GREENVILLE, S.C.
(ASSIGNEE).
Liquid Filtering Apparatus,
W77-09820 5D

TOKYO UNIV. (JAPAN). DEPT. OF MINERAL
DEVELOPMENT AND ENGINEERING.
Jet-Flame Saves Sludge Disposal Cost with
Deodorizing Effect,
W77-09737 5E

TROMSOE MUSEUM (NORWAY). MARINE
BIOLOGICAL STATION.
Deep Water Renewal and Associated Processes
in North Norway,
W77-09947 2L

UNION COLL., MIDDLESBORO, KY.
ENVIRONMENTAL EDUCATION CENTER.
Nitrate and Phosphate Content of Ground and
Surface Waters of the White River Drainage,
Northwest Nebraska,
W77-09743 5B

UNIVERSITY COLL., DUBLIN (IRELAND).
DEPT. OF SOIL SCIENCE.
Estimation of Components of Soil Cation
Exchange Capacity from Measurements of
Specific Surface and Organic Matter,
W77-09971 2G

UNIVERSITY COLL. OF SWANSEA (WALES).
DEPT. OF GEOLOGY AND OCEANOGRAPHY.
The Effect of Coastal Hydrodynamics on the
Echinoderm Distribution in the Sublittoral of
Oxwich Bay, Bristol Channel,
W77-09944 2L

UNIVERSITY OF NEW ENGLAND, ARMIDALE
(AUSTRALIA). DEPT. OF AGRONOMY AND
SOIL SCIENCE.
Evaluation of the Parameters of Soil
Phosphorus Availability Factors in Predicting
Yield Response and Phosphorus Uptake,
W77-09646 2G

UNIVERSITY OF SOUTHERN MISSISSIPPI,
HATTIESBURG. DEPT. OF GEOLOGY.
Flushing Characteristics of a Mississippi Dead-
End Canal System,
W77-09721 5B

UNIVERSITY OF THE WITWATERSRAND,
JOHANNESBURG (SOUTH AFRICA). DEPT. OF
GEOGRAPHY AND ENVIRONMENTAL
SCIENCE.
The Temporal Variation of Rainfall Runoff
Over the Summer Rainfall Region of South
Africa,
W77-10091 2B

UNIVERSITY OF WALES INST. OF SCIENCE
AND TECHNOLOGY, CARDIFF. DEPT. OF
APPLIED BIOLOGY.
The Effect of Parasitism on the Toxicity of
Cadmium to the Three-spined Stickleback,
Gasterosteus aculeatus L.,
W77-09666 5C

The Effect of Wind on the Distribution of
Chlorophyll A and Crustacean Plankton in a
Shallow Eutrophic Reservoir,
W77-09679 5B

UTAH STATE UNIV., LOGAN. COLL. OF
NATURAL RESOURCES.
Vegetation Manipulation--A Case Study of the
Pinyon-Juniper Type,
W77-09959 4C

UTAH STATE UNIV., LOGAN. DEPT. OF
LANDSCAPE ARCHITECTURE AND
ENVIRONMENTAL PLANNING.
The Functional and Aesthetic Uses of Two
Cache Valley, Utah, Canals,
W77-09796 6B

ORGANIZATIONAL INDEX

ZULULAND UNIV., EMPANGENI (SOUTH AFRICA). DEPT. OF BOTANY.

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). LAB. OF CHEMICAL ANIMAL PHYSIOLOGY.

ATP Content and Mortality in *Mytilus Edulis*
from Different Habitats in Relation to
Anaerobiosis,
W77-09671 5C

VANDERBILT UNIV., NASHVILLE, TENN. DEPT. OF ENVIRONMENTAL AND WATER RESOURCES ENGINEERING.

Standardization of Methylmercury Analysis,
W77-09775 5A

VERMONT UNIV., BURLINGTON. DEPT. OF PLANT AND SOIL SCIENCE.

Simulation of Plant Growth by Humic Sub-
stances,
W77-09963 2I

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT. APPLIED MARINE SCIENCE AND OCEAN ENGINEERING.

Water Color and Circulation Southern Ches-
apeake Bay. Part I. Southern Chesapeake Bay
Water Color and Circulation Analysis, Part II.
Skylab Mss Vs. Photography for Estuarine
Water Color Classification,
W77-10026 2L

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRONOMY.

Changes in Inorganic Nitrogenous Compounds
from Septic Tank Effluent in a Soil with a Fluc-
tuating Water Table,
W77-09907 5B

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.

Aeration: Proper Sizing is Critical,
W77-09905 5D

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.

Effect of Slope on the Threshold of Motion and
Its Application to Orientation of Wind Ripples,
W77-09955 2J

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). DIV. OF AGRICULTURAL METEOROLOGY.

Effect of Increasing Foliage Reflectance on the
CO₂ Uptake and Transpiration Resistance of a
Grain Sorghum Crop,
W77-09942 2D

WAPORA, INC., WASHINGTON, D.C.

Aquatic Field Surveys at Radford, Holston,
Volunteer, and Milan Army Ammunition Plants
- Volume I - Radford,
W77-09761 5C

Aquatic Field Surveys at Radford, Holston,
Volunteer, and Milan Army Ammunition
Plants, Vol. II - Holston - Final Report,
W77-09762 5C

Aquatic Field Surveys at Radford, Holston,
Volunteer, and Milan Army Ammunition
Plants, Volume IV - Milan, Final Report,
W77-09763 5C

WASHINGTON UNIV., FRIDAY HARBOR. FRIDAY HARBOR LABS.

The Effects of Salinity, Temperature, and Mer-
cury on Mortality of the Trochophore Larvae of
Serpula Vermicularis L. (Annelida:
Polychaeta),
W77-09684 5C

WASHINGTON UNIV., SEATTLE. DEPT. OF ATMOSPHERIC SCIENCES.

Deduction of Ice Particle Types in the Vicinity
of the Melting Layer from Doppler Radar Mea-
surements,
W77-09720 2B

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.

Nutrient Diversion: Resulting Lake Trophic
State and Phosphorus Dynamics,
W77-09604 5G

WASHINGTON UNIV., SEATTLE. DEPT. OF GEOLOGICAL SCIENCES.

Basal Till Fabrics of Modern Alpine Glaciers,
W77-09704 2C

WATER AND WASTEWATER TECHNICAL SCHOOL, NEOSHO, MO.

Removal of Nutrients from Treated Municipal
Waste Water by Wetland Vegetation,
W77-09916 5D

WATER RESOURCES ENGINEERS, INC., SPRINGFIELD, VA.

Impact of Economic Risks on Box Culvert
Designs--An Application to 22 Virginia Sites,
W77-10067 8B

WATSON (J. D. AND D. M.), HIGH WYCOMBE (ENGLAND).

Effluent Treatment Versus Disposal Through
Long Sea Outfalls,
W77-09895 5E

WESTERN AUSTRALIA DEPT. OF AGRICULTURE, SOUTH PERTH.

Seepage from Small Earth Dams,
W77-09932 8D

WESTERN MICHIGAN UNIV., KALAMAZOO. DEPT. OF BIOLOGY.

Limnological Investigation of the Muskegon
County, Michigan, Wastewater Storage
Lagoons. Phase 1,
W77-10061 5C

WESTON (ROY F.), INC., WEST CHESTER, PA.

The Fate of Pollutants in Subsurface Environ-
ments,
W77-09915 5B

Taconite Tailings Disposal, Reserve Mining
Company, Silver Bay, Minnesota.
W77-10062 5C

WESTVACO CORP., NORTH CHARLESTON, S. C. CHARLESTON RESEARCH CENTER.

Effect of Sorbed Organics on the Efficiency of
Ammonia Removal by Chloramine-Carbon Sur-
face Reactions,
W77-09902 5D

WISCONSIN UNIV., MADISON. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.

Classifying and Monitoring Water Quality by
Use of Satellite Imagery,
W77-09634 5A

WISCONSIN UNIV., OSHKOSH.

Wastewater Treatment by Natural and Arti-
ficial Marshes,
W77-09606 5D

WISCONSIN UNIV., OSHKOSH. DEPT. OF GEOLOGY.

Statistical Analysis of the Impact of Ground
Water Pumpage on Low-Flow Hydrology,
W77-09952 4B

WORCESTER POLYTECHNIC INST., WASHINGTON, D. C. PROJECT CENTER.

A Methodology for Comparative Evaluation of
Water Quality Indices,
W77-09632 5A

ZULULAND UNIV., EMPANGENI (SOUTH AFRICA). DEPT. OF BOTANY.

The Case for the Expanded Study of Fresh-
water Pollution Zoology,
W77-10086 5C

ACCESSION NUMBER INDEX

W77-09601	5D	W77-09679	5B	W77-09757	5D	W77-09835	8G
W77-09602	5D	W77-09680	5C	W77-09758	5D	W77-09836	5D
W77-09603	5G	W77-09681	5A	W77-09759	5D	W77-09837	5D
W77-09604	5G	W77-09682	5C	W77-09760	5C	W77-09838	4A
W77-09605	5G	W77-09683	5C	W77-09761	5C	W77-09839	8C
W77-09606	5D	W77-09684	5C	W77-09762	5C	W77-09840	5D
W77-09607	5C	W77-09685	2C	W77-09763	5C	W77-09841	8B
W77-09608	5C	W77-09686	5D	W77-09764	5C	W77-09842	5D
W77-09609	5C	W77-09687	8A	W77-09765	5C	W77-09843	5D
W77-09610	2H	W77-09688	8A	W77-09766	5B	W77-09844	5D
W77-09611	2D	W77-09689	8A	W77-09767	5B	W77-09845	5D
W77-09612	5C	W77-09690	5G	W77-09768	5C	W77-09846	5C
W77-09613	2G	W77-09691	5F	W77-09769	5A	W77-09847	5D
W77-09614	5C	W77-09692	8E	W77-09770	5B	W77-09848	5D
W77-09615	5B	W77-09693	7C	W77-09771	5D	W77-09849	5D
W77-09616	5B	W77-09694	2B	W77-09772	5C	W77-09850	5D
W77-09617	5C	W77-09695	8B	W77-09773	5C	W77-09851	5D
W77-09618	5C	W77-09696	2B	W77-09774	5G	W77-09852	5D
W77-09619	5C	W77-09697	5G	W77-09775	5A	W77-09853	5D
W77-09620	2I	W77-09698	2F	W77-09776	5A	W77-09854	5D
W77-09621	5C	W77-09699	2J	W77-09777	5A	W77-09855	5D
W77-09622	2I	W77-09700	2J	W77-09778	5A	W77-09856	8C
W77-09623	7B	W77-09701	2J	W77-09779	5C	W77-09857	5E
W77-09624	2G	W77-09702	2L	W77-09780	5C	W77-09858	5D
W77-09625	5C	W77-09703	2L	W77-09781	5C	W77-09859	5D
W77-09626	2G	W77-09704	2C	W77-09782	5A	W77-09860	5D
W77-09627	5C	W77-09705	2J	W77-09783	5C	W77-09861	5D
W77-09628	5C	W77-09706	2J	W77-09784	5C	W77-09862	5D
W77-09629	5C	W77-09707	2L	W77-09785	5C	W77-09863	5D
W77-09630	3C	W77-09708	2L	W77-09786	5C	W77-09864	5D
W77-09631	5C	W77-09709	2L	W77-09787	2H	W77-09865	5D
W77-09632	5A	W77-09710	2D	W77-09788	5A	W77-09866	5D
W77-09633	5A	W77-09711	2D	W77-09789	5C	W77-09867	5E
W77-09634	5A	W77-09712	2G	W77-09790	5C	W77-09868	5E
W77-09635	5A	W77-09713	2J	W77-09791	5C	W77-09869	5E
W77-09636	5A	W77-09714	2L	W77-09792	5C	W77-09870	5D
W77-09637	2F	W77-09715	7B	W77-09793	5C	W77-09871	5D
W77-09638	5B	W77-09716	2C	W77-09794	5C	W77-09872	5D
W77-09639	2G	W77-09717	2C	W77-09795	5D	W77-09873	5D
W77-09640	3F	W77-09718	2C	W77-09796	6B	W77-09874	5D
W77-09641	3F	W77-09719	2B	W77-09797	2I	W77-09875	5D
W77-09642	3F	W77-09720	2B	W77-09798	4D	W77-09876	5D
W77-09643	2G	W77-09721	5B	W77-09799	7B	W77-09877	5D
W77-09644	5B	W77-09722	5B	W77-09800	3F	W77-09878	5D
W77-09645	2G	W77-09723	2L	W77-09801	3F	W77-09879	5D
W77-09646	2G	W77-09724	5D	W77-09802	3F	W77-09880	5D
W77-09647	5B	W77-09725	5G	W77-09803	8C	W77-09881	5D
W77-09648	2G	W77-09726	5B	W77-09804	3A	W77-09882	5E
W77-09649	5B	W77-09727	5D	W77-09805	5D	W77-09883	5D
W77-09650	2G	W77-09728	5D	W77-09806	3A	W77-09884	5D
W77-09651	2G	W77-09729	5A	W77-09807	4C	W77-09885	5D
W77-09652	2G	W77-09730	5C	W77-09808	5F	W77-09886	5D
W77-09653	5B	W77-09731	5A	W77-09809	7B	W77-09887	5D
W77-09654	5D	W77-09732	5D	W77-09810	3F	W77-09888	5D
W77-09655	3F	W77-09733	5D	W77-09811	3F	W77-09889	5D
W77-09656	3F	W77-09734	1B	W77-09812	5D	W77-09890	5D
W77-09657	3F	W77-09735	5B	W77-09813	5A	W77-09891	5G
W77-09658	5B	W77-09736	5A	W77-09814	3F	W77-09892	5D
W77-09659	5B	W77-09737	5E	W77-09815	5D	W77-09893	5D
W77-09660	5C	W77-09738	3E	W77-09816	5D	W77-09894	5A
W77-09661	5B	W77-09739	5C	W77-09817	3A	W77-09895	5E
W77-09662	5C	W77-09740	3E	W77-09818	5G	W77-09896	5D
W77-09663	5C	W77-09741	5F	W77-09819	5G	W77-09897	5A
W77-09664	5C	W77-09742	5A	W77-09820	5D	W77-09898	5D
W77-09665	5C	W77-09743	5B	W77-09821	5D	W77-09899	5D
W77-09666	5C	W77-09744	5D	W77-09822	8B	W77-09900	5D
W77-09667	5C	W77-09745	5D	W77-09823	5D	W77-09901	5A
W77-09668	5C	W77-09746	5A	W77-09824	5D	W77-09902	5D
W77-09669	5C	W77-09747	5A	W77-09825	5D	W77-09903	5D
W77-09670	5C	W77-09748	5A	W77-09826	5D	W77-09904	5A
W77-09671	5C	W77-09749	5A	W77-09827	8C	W77-09905	5D
W77-09672	5C	W77-09750	2K	W77-09828	5D	W77-09906	8C
W77-09673	5C	W77-09751	5A	W77-09829	5D	W77-09907	5B
W77-09674	5C	W77-09752	5A	W77-09830	5D	W77-09908	5A
W77-09675	5C	W77-09753	2K	W77-09831	5E	W77-09909	5A
W77-09676	5B	W77-09754	5A	W77-09832	8F	W77-09910	5C
W77-09677	5A	W77-09755	5C	W77-09833	8G	W77-09911	5B
W77-09678	5C	W77-09756	5G	W77-09834	5D	W77-09912	5D

ACCESSION NUMBER INDEX

W77-09913

W77-09913 5D
W77-09914 5B
W77-09915 5B
W77-09916 5D
W77-09917 5B
W77-09918 5E
W77-09919 5A
W77-09920 5D
W77-09921 5G
W77-09922 5C
W77-09923 5G
W77-09924 8F
W77-09925 5B
W77-09926 5B
W77-09927 4A
W77-09928 5B
W77-09929 3A
W77-09930 2G
W77-09931 5D
W77-09932 8D
W77-09933 2A
W77-09934 6E
W77-09935 4A
W77-09936 2H
W77-09937 2G
W77-09938 2I
W77-09939 3F
W77-09940 5C
W77-09941 2D
W77-09942 2D
W77-09943 4A
W77-09944 2L
W77-09945 5A
W77-09946 2L
W77-09947 2L
W77-09948 2L
W77-09949 5B
W77-09950 2J
W77-09951 2J
W77-09952 4B
W77-09953 2D
W77-09954 2D
W77-09955 2J
W77-09956 2B
W77-09957 2G
W77-09958 2B
W77-09959 4C
W77-09960 2G
W77-09961 2G
W77-09962 2G
W77-09963 2I
W77-09964 2I
W77-09965 2G
W77-09966 5B
W77-09967 2G
W77-09968 2G
W77-09969 3F
W77-09970 5B
W77-09971 2G
W77-09972 2G
W77-09973 2G
W77-09974 2G
W77-09975 2G
W77-09976 5B
W77-09977 2G
W77-09978 3C
W77-09979 2C
W77-09980 2G
W77-09981 5B
W77-09982 2L
W77-09983 2L
W77-09984 8B
W77-09985 6G
W77-09986 8B
W77-09987 8B
W77-09988 8B
W77-09989 8B
W77-09990 8B
W77-09991 7C

W77-09992 4A
W77-09993 2E
W77-09994 5B
W77-09995 5B
W77-09996 4B
W77-09997 7C
W77-09998 7C
W77-09999 7C
W77-10000 7C
W77-10001 7C
W77-10002 7C
W77-10003 2E
W77-10004 2A
W77-10005 4B
W77-10006 5A
W77-10007 2H
W77-10008 2F
W77-10009 2E
W77-10010 5C
W77-10011 4A
W77-10012 4B
W77-10013 7C
W77-10014 2F
W77-10015 5A
W77-10016 8B
W77-10017 8B
W77-10018 8B
W77-10019 8B
W77-10020 8B
W77-10021 2G
W77-10022 2L
W77-10023 5C
W77-10024 5A
W77-10025 2L
W77-10026 2L
W77-10027 5C
W77-10028 5C
W77-10029 2L
W77-10030 2L
W77-10031 5G
W77-10032 2L
W77-10033 5B
W77-10034 5B
W77-10035 2L
W77-10036 2L
W77-10037 5B
W77-10038 2I
W77-10039 2L
W77-10040 8B
W77-10041 8B
W77-10042 8B
W77-10043 8B
W77-10044 8B
W77-10045 8B
W77-10046 8B
W77-10047 8B
W77-10048 8B
W77-10049 5G
W77-10050 5E
W77-10051 5C
W77-10052 5C
W77-10053 5C
W77-10054 5C
W77-10055 5B
W77-10056 5C
W77-10057 4A
W77-10058 5C
W77-10059 4A
W77-10060 7B
W77-10061 5C
W77-10062 5C
W77-10063 5C
W77-10064 2H
W77-10065 2L
W77-10066 2L
W77-10067 8B
W77-10068 8A
W77-10069 8B
W77-10070 8A

W77-10071 8A
W77-10072 2L
W77-10073 8C
W77-10074 4A
W77-10075 4D
W77-10076 5G
W77-10077 8A
W77-10078 8G
W77-10079 3F
W77-10080 5C
W77-10081 5D
W77-10082 5G
W77-10083 2E
W77-10084 5A
W77-10085 2B
W77-10086 5C
W77-10087 5F
W77-10088 2B
W77-10089 2L
W77-10090 2E
W77-10091 2B
W77-10092 5A
W77-10093 5A
W77-10094 5D
W77-10095 5A
W77-10096 2H
W77-10097 2H
W77-10098 6G
W77-10099 2H
W77-10100 2F

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W77-09638--09659 09960--09980	43
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W77-09601--09602 09822--09909 09911--09924	104
Illinois State Water Survey, Hydrology	W77-09693--09723 09943--09958	47
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W77-09724--09729 09731--09742 09744--09760	35
University of Arizona, Arid Land Water Resources	W77-09929--09934 09937, 09939 09941--09942 09959	11
University of Wisconsin, Eutrophication	W77-09603--09609 09612 09614--09619 09625 09627--09629 09631--09636 09788 10049--10063	40
University of Wisconsin, Water Resources Economics	W77-10067	1
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W77-09637, 09685 09795--09797 09925--09928	9
C. OTHER		
Army Engineer Waterways Experiment Station	W77-09981--09990 10016--10020 10040--10048	24

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
BioSciences Information Service	W77-09610--09611 09613 09620--09624 09626, 09630 09730, 09743 09787, 09807 09910 09935--09936 09938, 09940 10010, 10021 10028, 10038 10064--10066	26
Department of Water Affairs	W77-09686--09692 10068--10100	40
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W77-09660--09684 09761--09786	51
Environmental Information Sciences, Inc. (Gas Bubble Disease)	W77-09789--09793	5
Environment Canada (WATDOC)	W77-09794	1
Ocean Engineering Information Service (Patents)	W77-09798--09806 09808--09821	23
Ocean Engineering Information Service (Outer Continental Shelf)	W77-10022--10027 10029--10037 10039	16
U. S. Geological Survey	W77-09991--10009 10011--10015	24

AL

26

40

51

5

1

23

16

24



